THE

REPERTORY

OF

ARTS, MANUFACTURES,

AND

AGRICULTURE.

Consisting of

ORIGINAL COMMUNICATIONS,

SPECIFICATIONS OF PATENT INVENTIONS,

PRACTICAL AND INTERESTING PAPERS,

SELECTED FROM

THE PHILOSOPHICAL TRANSACTIONS AND

SCIENTIFIC JOURNALS OF ALL NATIONS.

MONTHLY INTELLIGENCE

RELATING TO

THE USEFUL ARTS,

PROCEEDINGS OF LEARNED SOCIETIES,

AND

NOTICES OF ALL PATENTS GRANTED FOR INVENTIONS.

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OF THE

TWENTY-FIFTH VOLUME, SECOND SERIES.

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On

LIST OF PLATES.

THE

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AGRICULTURE.

No. CXLV. SECOND SERIES. June 1814.

Specification of the Patent granted to WILLIAM HORROCKS, *of Stockport, in the County of Chester, Cotton Manufacturer; for his further Improvement to a Machine for weaving of Cotton and other Goods, by Hand, Steam, Water, or other Power.*

Dated July 31, 1813.

With a Plate.

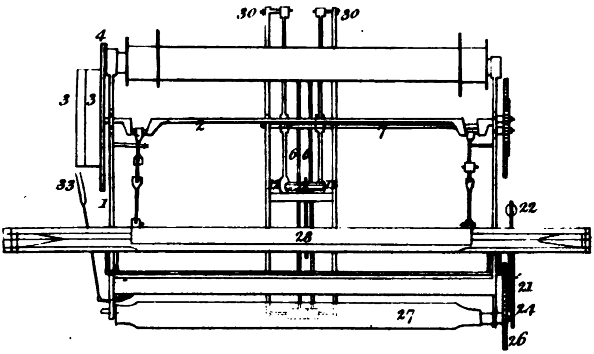
TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said William Horrocks do hereby declare that the nature of my said invention, and the manner in which the same is to be performed, are particularly described in manner following; that is to say: In the drawing hereunto annexed and respectively numbered according to the denominations of (Plate I.) Figs. 1, 2, 3, 4, 5, and 6; the figures 1, 2, 3, 4, and 5, represent a loom, or such parts thereof by distinct and different orthographic views or view, nearly of the nature of sections, as it has been expedient and necessary to show for the

more perfect description of my said further improvement, and the application thereof to the said loom, or to such other looms wherein the lathe is worked by a crank; and Fig. 6 represents my said improvement, having the parts thereof marked by small letters of the alphabet, and the said improvement is also seen in Fig. 5 in its place, where the same small letters denote the same things in both figures; and further, the frame of the loom as is seen in Figs. 1, 2, 3, 4, 5, and a part of the same in Fig. 6 is marked 1, 1, 1, &c. Number 2 denotes the shaft of the crank, at one end of which is fixed a loose and fast pulley marked 3 3 (Figs. 1 and 4), and at the same end is fixed the fly-wheel 4, for the purpose of regulating the motion of the machine; at the other end of the crank shaft is fixed the wheel 5 (Figs. 3 and 5), which moves another wheel 6, double the diameter of the wheel 5, and on the shaft 7 of the wheel 6 are fixed the tappets 8, 8, &c. Figs. 3 and 5. These tappets alternately depress and raise the treddles 9, 9, &c. represented in Figs. 1 and 4; to the tappets are fixed the friction rollers 10, 10, in Figs. 3 and 5, acting alternately on the mitre-piece 11, 11, Figs 3 and 4; to the ends of these levers is fixed a strap passing over the pulley 13, 13, Figs. 1 and 2; this pulley is fixed on the shafts 14, Fig. 1, and at the other end is screwed the picking-peg 15, Fig. 2, to the top of which are tied the cords 16, 16, Fig. 2, which connect the pickers 17, 17, Fig. 2, with the peg 18, 18. Figs. 2, 3, 4, and 5, are the lathe swords. 19, 19, Figs. 2 and 5, is a stud fixed in the lathe sword, which acts on the lower parts of the cross piece 20, Fig. 5; and at the top of 20 is a slender bar of iron 21, Figs. 1 and 5, bent at the end to a right angle which acts on the ratchet wheel 23, Figs. 1 and 5, and draws up the cloth as it is woven, by means of the weight 22, 22, Figs. 1 and 5. 24, Figs. 1 and

and 5, is a catch, bent in the same manner as 21, which prevents the ratchet wheel 23, from turning back. Behind the ratchet wheel is a small wheel 25, Fig. 5, fixed on the ratchet wheel, and working in the wheel 26, Fig. 5, which is fixed on the end of the cloth beam 27, Figs. 1, 2, and 4. 28, 28, &c. in Figs. 1, 2, 3, 4 and 5, give the different views of the lathe. 29, Fig. 2, is the frame in which the treadles 9, 9, are fixed. 30, Figs. 1 and 3, are studs to which the picking levers 11, 11, Figs. 1, 3, 4 and 5, are fixed. 31, 31, &c. in Figs. 2, 3, 4 and 5, are pullies to which the healds are hung; 32, 32, Figs. 1, 4, and 5, is the yarn beam, which is not represented in Fig. 3, for the purpose of giving a view of the back part of the lathe; 33, Fig. 1, is the fork for throwing the loom in or out of motion; 34, Fig. 5, is a stud, to which is fixed a lever for the purpose of weighting the yarn beam. Fig. 6 represents my said further improvement, drawn upon a larger scale than that of the corresponding parts in the other figures, or than that of the said improvement as seen in Fig. 5, and with regard to the actual scale or size, the same must necessarily be different for different kinds of work. A, denotes the centre of the crank shaft; A B, the crank arm to which the piece *g* is jointed at B; and in the said piece *g*, are two other centers C and *d*. The letter *h* denotes a bar, called the pendant bar, which is moveable upon a centre *f*, adjustable in a long hole or slit at the top of the standard *i*, and joined with the piece *g*, at the centre C. The letter *m*, denotes another piece joined with *g*, at the centre *d*, and with E, at the other end thereof, by a like centre at the upper end of the lathe sword, as seen in Fig. 5, where N denotes the centre of motion of the lathe sword on one side, so that the centre A *f*, and N, are stationary; and the centres B, *c*, *d*, and E, are moveable; and

it may be clearly apprehended that if B and E, had been connected by one inflexible bar or piece, the motion of E, and that of the lathe itself, would have been alternately back and forwards in the manner of a common treadle; that is to say, very slow at the places of return, and quickest in the middle of each course out and home. But in my said improvement as here shown, the connection between B and E, is made by two pieces *g* and *m*, jointed, and consequently flexible at *d*, and the said two pieces are prevented from permanently forming a straight line, because the piece *h* governs or modifies the position of *g*, by means of the centre C; and the lathe sword governs or modifies the position of the piece *m*, by means of the center E; and whilst the crank arm A B, is turned round, the part E will be moved not according to the action of a common crank, but more swiftly or slowly accordingly as the flexure or action of bending at *d* shall or may concur with, or be opposite in its effect to the motion, which could or might have been produced at E, by means of an inflexible bar, and such concurrence or opposition will vary accordingly as the absolute, or relative, or proportional lengths of all the moving pieces, and the situations of the centres respectively, shall or may be varied; but if the said lengths and situations be taken, made, or adopted, as set forth in the said Fig. 6, the pieces *g* and *m* will be very suddenly extended into a straight line by the motion of the centre B, towards and into the position nearest to E; and so likewise by the continuance of the motion of B beyond that position, the same pieces will be again suddenly bended, and E will be drawn back to a position where the effects of the crank action, and of the flexure at *d* will be nearly balanced, and E will remain during a considerable time or part of the revolution of the crank, in

Fig. 1.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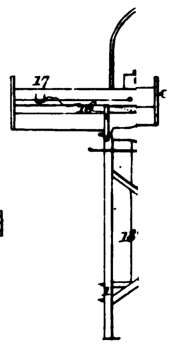
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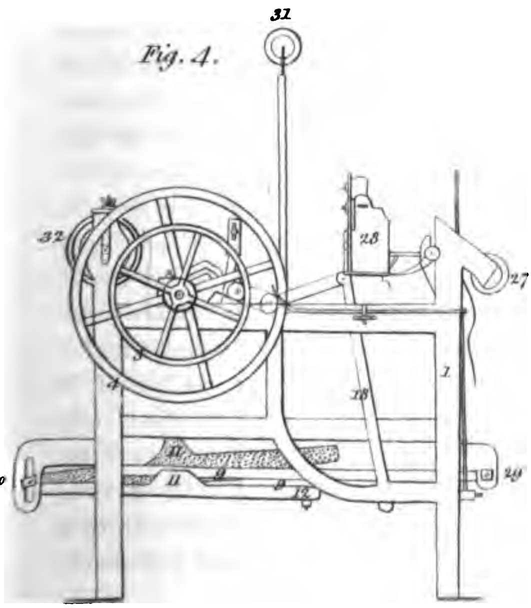
Fig. 4.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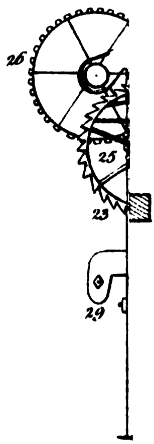
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in a state nearly motionless; or in other words, the lathe will advance quickly, and give an effective stroke to the weft, and then withdraw quickly to a stationary position. And among the beneficial consequences will be the following: that the shuttle may pass the shed while the lathe is so stationary, and also that a larger shuttle may be used sufficient to hold a full-sized cop, and also that the waste of weft from the bottoms in the cops will be less; and also, that from the smartness of the stroke there will be less weight required upon the yarn beam, and the warp being less tense or tight, the healds will require less power to work then *, and consequently less charge of first mover, and also that fewer threads of the warp will break in the working, whence the time and expense of stopping and knotting them will be saved; and also, that from the same reason of the smartness of the stroke more threads of the weft can and may be laid in the inch, and the fabric will be stronger, more uniform, and better wrought in all respects.

In witness whereof, &c.

Specification of the Patent granted to ROBERTSON BUCHANAN, *of the City of Glasgow, Civil Engineer; for certain Improvements in the Means of impelling Vessels, Boats, Barges, and Rafts, which may be also applied to the moving of Water-wheels and Wind-mills, the raising of Water, the dredging, cleansing, or deepening of Rivers and Harbours, and the impelling of other Machinery.*

Dated October 18, 1813.

With an Engraving.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said Robertson Buchanan do hereby declare

* Compared with the record in the office.

that

that the nature of my said invention, and manner of performing the same, are particularly described and ascertained as follows; that is to say: In the first place my said invention is established upon a mathematical theorem, which may be enumerated in the words here underlined, namely: *If two equal rings or circular lines in the same plane, or in planes parallel to each other, be conceived to revolve each upon its respective centre in its own plane, with one and the same uniform velocity, and in the same direction with regard to parts of the rings or lines alike situated, and any point be taken in one of the rings or lines, and a right line be drawn from that point parallel to a line supposed to join the centres, until it meets the other ring or circle, then I say the right line so drawn will be equal to the line of distance between the centres, and will continue equal and parallel to that line of distance during the whole of every revolution so made.* And the demonstrative proof of the said theorem being very easily deducible by any person acquainted with the elementary principles of geometry, and not being needful to enable a workman to perform my said invention, I have not for those reasons considered it to be requisite that I should enlarge upon the same in this place.

Secondly, the circle *a*, *c*, *e*, *g*, and the circle 1, 2, 3, 4, in Fig. 1, (Plate II.) denote the rings or circular lines before-mentioned, and Y and X denote the centres thereof; and the line 1 a parallel, and equal to X Y, the line of distance of the centres will continue equal and parallel to that line of distance in the positions 2 *c*, and 3 *e*, and 4 *g*, and in all other positions into which the point 1 can be brought during the uniform, equal, and similarly-directed revolutions of the two circles.

Thirdly, if a wheel which I shall here call the *pitch wheel* be constructed, and here denoted by the circle 1, 2, 3, 4, Fig. 1, having four or any other number of paddles *a b*, *a c*,

a c, *f e*, *h g*, capable of being moved or shifted in position upon the respective axes or centres thereof, 1, 2, 3, 4, and the extremities of the said paddles, *a*, *c*, *e*, *g*, or any arms or connecting pieces equal in length to X Y, be attached (under the conditions before set forth) to another wheel or revolving piece, which I shall here call the *connection wheel or piece*, it will be a necessary consequence that if one of the said wheels be made to revolve, the other wheel will also revolve in the same direction and with the same velocity, and the paddles will continue parallel to X Y, and to each other (excepting only in the case wherein the said cases or centres may be governed by arms or connecting pieces, and the paddles themselves be also capable of having their positions on the said axis or centres varied, and then each paddle will continue parallel to itself as it may have been so first posited); and fourthly, Fig. 2, numbers 1, 2, and 3, denote by views of the nature of two vertical sections, and one ground plan or section, the said pitch wheel and connection wheel or piece fitted up and connected with the paddles; and in all the drawings, the same letters and figures indicate the same parts or things. B denotes the axis or arbor of the pitch wheel, which wheel is or may be made double in order to support the axles of the paddles; and C denotes a circular fixed piece which serves as an arbor for the connecting wheel or piece to revolve upon by its smooth and fitted socket; and the said circular piece is by the construction eccentric with regard to the pitch wheel, and sufficiently large to allow the arbor B of the pitch wheel to pass through it without interfering with the motion of the connecting wheel or piece. And further, at A 1, A 2, A 3, and A 4, are seen the arms or connecting pieces always parallel to the line between the centres X Y; but in such constructions of machinery

machinery as do not require the arbor B, or any arbor or axis for the pitch wheel to pass through, as here delineated, then instead of the piece C, may be substituted a simple pivot or any other kind of centre to govern the circular motion of the connecting circle or piece. And moreover, in such cases as may require that the position of all the paddles should be changed at the same time, with regard to surrounding fixed objects, by a motion equivalent to that of weathering or changing their obliquity, I do produce such and the said change by any well-known means of construction, by which the centre X can be made adjustable in position around, and preserving constantly the same distance from the centre Y, and I do accordingly change the position of the said centre X, and thereby also the obliquity of the said paddles, by virtue or reason of the constant condition, that the arms A 1, A 2, A 3, and A 4, will continue parallel to the line X, Y, joining the centres of the pitch wheel and connection wheel, in what manner soever the said line X Y may at any time be placed. And I the said Robertson Buchanan do further declare, as to the practice of my said invention in the impelling of vessels, boats, barges, or rafts, I do fit up the same with one or more wheels, having paddles and other apparatus as before described, and do cause the pitch wheels to revolve by the action of steam or any other suitable first mover, and thereby to strike the paddles duly into and against the water, so as by the usual re-action to produce a progressive motion of and in the said vessels, boats, barges, or rafts; and I do fix or adjust the centre X in such manner, that the paddles shall have their surfaces of action perpendicular to that of the water, or nearly so, namely, with the upper borders or edges thereof inclined forward more or less by trial and observations, as the velocity

Fig. 1.

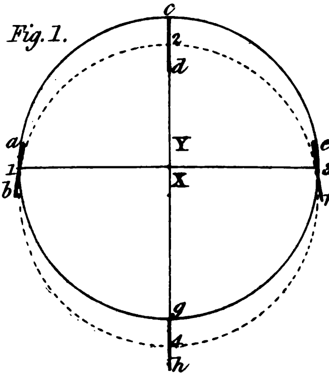


Fig. 2.

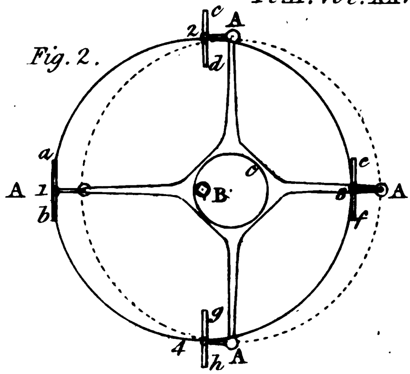


Fig. 2. No. 3.

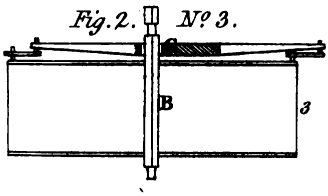
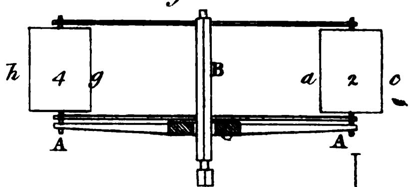
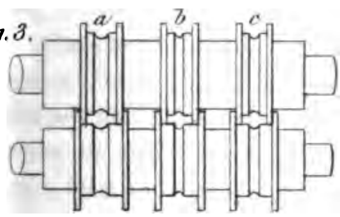


Fig. 2. No. 2.



Mr. Osborne's Patent.

Fig. 3.



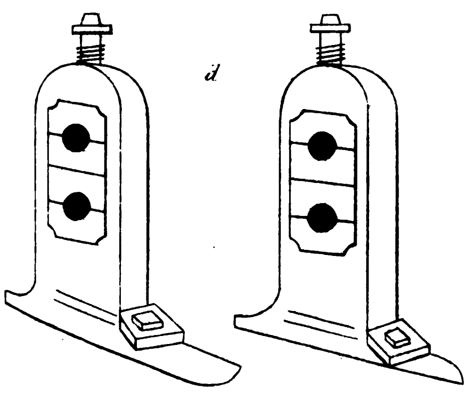
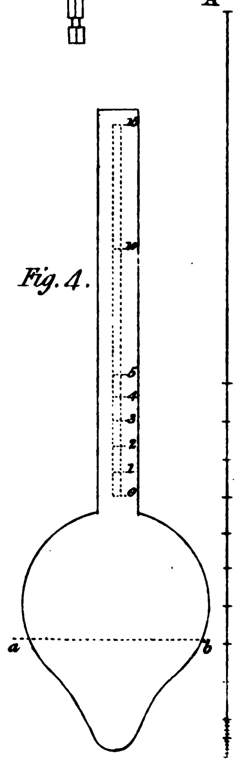


Fig. 4.



velocity through the water is greater or less, in order that the resistances from the immersion and delivery of the paddles may be the least, and the action from the direct impulse of the lower paddles may be the greatest possible. And, moreover, with regard to undershot wheels, I do adjust the paddles in the like manner, so that the loss of force by the first immersion and by the lifting of the tail water may be the least, and the direct impulse the greatest possible. And with regard to breast wheels, the floats must be set at such an obliquity as may best and most effectually subject them to the action of the water. And with regard to overshot or bucket wheels, I do substitute in the place of floats, certain shallow vessels or horizontal floats, with ledges on the upper side. And I do make one of the sides or ledges thereof to turn on pivots or otherwise, in order to discharge and empty the water at the lower situation of the revolving wheel, by means of a tripping piece there placed for that purpose, or by other fit means. And I do fill or charge the said vessels or horizontal floats with water, when at the upper part of the revolution in the usual manner. And with regard to wind-mills with upright shafts, I do apply and use my said improvements, taking care that the floats or sails shall be opposed at right angles to the direction of the wind, when in that position where the radius of the pitch wheel is also in the place of the float, and also that a fit cover shall be applied to defend the floats or sails from the action of the wind in their returning semi-revolution. And the said last application and use of my said improvements will be equally effectual in mills, of which the principal shaft shall be horizontal or oblique instead of being vertical, provided that in all such cases the said shaft shall be itself at right angles to the direction of the wind. And farther, whensoever the strength of the wind,

or nature of the work, shall or may render it expedient to alter the obliquity or weathering of the floats or sails, the same may be done by altering the situation of the centre X; and if required, such alteration may be made during the actual work by means of the centrifugal apparatus, called the governor, or by any other well known and appropriate apparatus, operating by means of the velocity of the mill itself. And I do further declare, that the vessels or horizontal floats hereinbefore described as applicable to overshot mills, may also be applied to raise water by my said improvements, and in this case the pitch wheel must be moved by any fit first mover, and the buckets filled below and emptied above by the method before described, or any other well known method. And the dredging from the bottom of waters may also be performed by scraping buckets attached to the wheels instead of the paddles aforesaid, and the said buckets, after having charged themselves by acting upon the ground at bottom, are discharged into an appropriate channel or conveyance near the top by the action of a metallic piece resembling a broad hoe, and placed there for that purpose. And lastly, with regard to other machinery, and the application of my said improvements, and also the variations of a structure and materials, and the relative position of the parts of my said improvements, the same may be easily understood and performed by any competent workman, from what hath been already specified, and do not therefore require any further elucidation or remark.

In witness whereof, &c.

Specification

Specification of the Patent granted to HENRY OSBORN, *of Whitmore-House, in the Parish of Aston, in the County of Warwick; for making Tools for tapering Cylinders of different Descriptions, made of Iron, Steel, Metal, or Mixture of Metals; and also for tapering Bars of Iron, Steel, Metal, or Mixture of Metals.*

Dated October 15, 1813.

With an Engraving.

TO all to whom these presents shall come, &c. NOW KNOW YE, that I the said Henry Osborn, in compliance and performance of the said proviso, do hereby declare that this instrument in writing, under my hand and seal, doth particularly describe and ascertain the nature of my said invention, and the manner in which the same is to be performed, by the description in writing hereinafter mentioned; that is to say: I make spindles of wrought or cast-iron, or metal or mixture of metals, of a square, or any other convenient form, and of any length, as may best suit my purpose. To the said spindles, working in cast or wrought iron, or metal frames, on spindles, so made, I fix collars or tools, made of cast or wrought iron, or metal, or mixture of metals. In these collars or tools grooves or hollows are made, taper in form, and various as to size, and adapted to the intended purposes; by means of which, and being applied to mill or machine power, I taper my cylinders, bars of iron, steel, or other metals, and implements, in such manner as may be required for all the purposes intended for the tapering a cylinder, and so forth, which is to make a gun or pistol barrel or any other article, I fix one, two, three, or more tools or collars, on one or more spindles, and work them in pairs.

 And,

And, for the better explaining my ideas, I annex a drawing of a spindle, on which tools or collars are fixed; and also a frame in which the same is to work. See (Fig. 3, Plate II.) *a*, *b*, *c*, and *d*.

My tools thus prepared, I proceed as follows: I take cylinders, or bars of steel, iron, metal, or mixture of metal, and place them in a furnace, properly constructed; and having made them of a proper heat, I pass the same through the said tools or collars. First through *a*, second through *b*, third through *c*; but I do not confine myself to any given number, but go from one to any number, as occasion may require, until I have accomplished my purpose.

And, lastly, I do declare, that any workman, of competent skill, in the making and constructing of tools for tapering, and the like purposes, will find no difficulty in forming, making, and completing the same, from the general instructions hereby given.

In witness whereof, &c.

Specification of the Patent granted to Robert Campion, *of Whitby, in the County of York, Manufacturer; for a new and improved Method of making and manufacturing double Canvas and Sail Cloth with Hemp and Flax, or either of them, without any Starch.*

Dated April 13, 1813.

To all to whom these presents shall come, &c. Now know ye, that in compliance with the said proviso, I the said Robert Campion do hereby deccribe and ascertain the nature of my said invention, and the manner in which the same is to be performed, as follows; that is to say; My new and improved method of making and manufac-

manufacturing double canvas and sail-cloth with hemp and flax or either of them, without any starch whatever, consists in first spinning the warp yarn either by hand, or with the sort of machinery generally used for such purposes, without water or dampness of any kind whatever; afterwards properly cleansing and bleaching the same in the best manner, and having made it perfectly dry from that process, placing and working it on a machine similar to those commonly used in cotton manufactories; round the upper bobbins of which machine, the same is rolled in single threads, so as that when the said machine is put in motion in the usual manner, the effect thereof is to untwist those threads, and take out of them all the twist that was made therein by the operation of spinning, and to twist or interweave two of them into one thread on to half the number of other bobbins in the lower part of the said machine, the reverse or contrary way to that in which the single threads or warp had been before twisted; by this process, the yarn is not so hard twisted as at first, and in the operation of thus reversing the twist, the fibres of the flax are so closely united, and are laid or arranged so perfectly level and even in every respect as to render the warp yarn or threads much stronger than any double threads are by the usual mode of manufacture with starched chains; the double threads or warp yarn being thus prepared and twisted together into one chain or warp, the same is thereby preserved from injury whilst passing through the slay walk in the subsequent operation of weaving, and thus the necessity of using any starch or substitute for starch whatever, which in the ordinary mode of manufacture is used only for the purpose of uniting the two threads or warp, and making them smooth so as to pass through the slay walk with facility and without injury, is altogether

altogether superseded. The canvas thus manufactured is much more pliant than what is made with starch or in any other manner, and is stronger, not only because its being so very regular, and even necessarily makes the stress equal in every part, but because in consequence of there being no starch used in the manufacture, the weight of that material, which is considerable in every web or piece, must be supplied by an additional quantity of warp and woof, and being soft and pliant, it will thicken when used, and become of a closer texture without breaking or running up, or being liable to mildew or turn black. Where hemp is used in the manufacture, I hackle the same with soft soap and a very small proportion of oil in preference to the entire use of oil, as generally practised; for this preparation lays the fibres as even as oil does, and at the same time counteracts the viscous qualities of the hemp, and with a proper quantity of pearl or pot-ash assists in bleaching the yarn, and obtaining a good colour in that process. The advantages of my invention of course extend to canvas made of unbleached yarn, and the only difference in the manufacture thereof is, the process of bleaching being then dispensed with.

In witness whereof, &c.

Of

Of the Superiority of the newly-invented Street Lamps.

Communicated by the Patentee, Lord Cochrane.

With a Plate.

It is not only generally admitted, that the most familiar objects are those in which error or defect is the most likely to escape detection; but that the minds of men are apt to revolt at innovations which violate their usual habits or preconceived opinions. Hence it but too frequently happens, that he who at length discovers an error which time and familiarity have sanctioned, and devises the means of removing it, has the more difficult task to accomplish, of prevailing with society to renounce the evil for the remedy. Innumerable instances are on record, in which advantages of high importance to society have been rejected by one generation, which, when admitted by a succeeding one, have been found of such evident utility, that it became matter of astonishment that a preceding race should have hesitated even for a moment to adopt them.

It is true, that in the present case there are many persons so far conversant with the theory and practice of artificial illumination, as to be sensible of the inconvenience, the inadequacy, and the more than commensurate expense, of the method by which the streets of this metropolis, and of most considerable towns in the united kingdom, are at present illuminated. But as material opposition to the improved Plan now offered to the public, may, nevertheless, be anticipated from various causes, it is deemed necessary to shew both the existence of the evil, and the efficacy of the means provided to remove it.

For

For these purposes, and in order to save repetition, we refer the reader to the Specification of the Patent granted to Lord Cochrane, published in No. 142 of this work, and to the numerous drawings thereunto annexed, wherein the defects in the construction of the present Street Lamps are pointed out, and the manner in which they may be remedied. But for more immediate reference, four figures are hereunto annexed.

Fig. I (Plate III) represents a common Street Lamp, delineated on a reduced scale.

D E F is a glass globe.

D G F the top cover.

A B the pipe at which the consumed air endeavours to escape, and the atmospheric air to enter, at the holes *o p*.

C shews the situation in which the oil-holder is usually suspended.

E K L represents the circle of light, and H C I the angle of beneficial rays.

It is obvious that there is no proper entrance for atmospheric air, or any aperture exclusively for the exit of the consumed air; that the efforts of the heated and consumed air to escape upwards, and of the cooler atmospheric air to descend into the globe, being opposite, the progress of both is impeded, and that the pure air mixing with the consumed air, becomes immediately contaminated, whereby a great proportion of the oil is thrown off in the state of smoke, which, if combined with more oxygen, would afford light instead of lamp-black.

Fig. II shews an application of the new principle.

Let D E F represent a glass globe or case, capable of transmitting the rays of light, and of excluding the entrance of air. K M a non-absorbing cover.

Upon

FIG. I

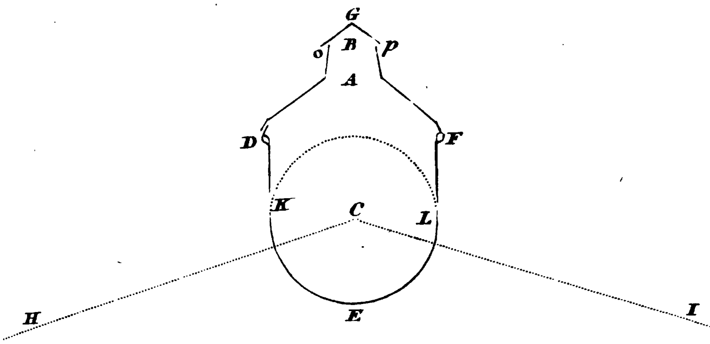


FIG. II

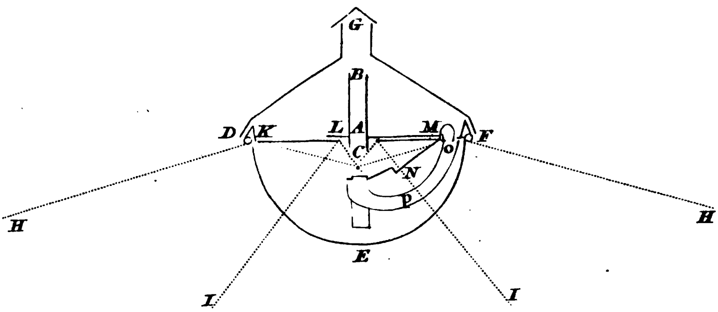


FIG. III

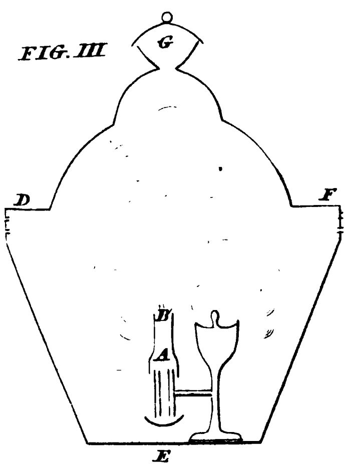
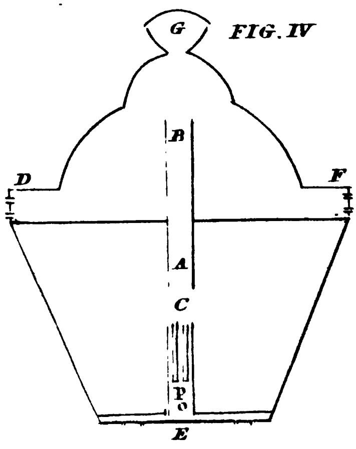


FIG. IV



Neele sc. Strand.

Upon the non-absorbing cover let a supplementary plate L M be placed, moveable on the axis M; on which erect the tube A B, and suspend an oil-holder N, on the axis M.

Let *o p* be an opening or tube for the entrance of pure air, and M O a wire attached to the plate L M, or otherwise.

Lift the plate L M by the tube A B, until the wire M O having touched the oil-holder N at O, brings it up to the aperture in the centre of the non-absorbing cover; then pour in the oil, affix the wick, apply a light, and return it to the position in which it appears in the figure.

It is obvious that the heated column of air A B by its propensity to ascend, will cause the more weighty atmospheric air to flow in at openings D and F, in the exterior cover D G F, and descend through the tube *o p*; and pass by or envelope the flame at C, holding its full proportion of oxygen, and thus exciting the most brilliant and beautiful light. It is equally obvious, that the angle of reflected light K C F includes as many rays of light as now fall beneficially on the ground; and as the angles of incidence and reflection are equal, those rays which are not absorbed are returned between the lines L I, K H, and A I, F H; and consequently become beneficial.

Fig. III. represents an Argand's Lamp, under circumstances similar to those of the common Lamp (Fig. I); the consumed air emitted from the transparent tube A B, passing and repassing, and diluting and contaminating the air in the case D E F G, and all that gains admittance.

The double and quadruple Argand burners of the opera and playhouses are still more rapidly suffocated in exhausted air.

 Fig.

Fig. IV. shews my simple remedy for this defect: insert the bottom of Argand's burner through an aperture or into a tube, or into a double bottom having an aperture or apertures to the exterior; and thus the air will flow through, and pass the flame C, undiminished in its power, whatever quantity of air may be consumed, and whatever length of time the flame may burn. *On the new principle,* carried to its full extent, the *Argand burner is deprived of its transparent tube,* which hitherto has been deemed indispensible.

For further illustration of the defects of the Lamps now in use, it is only necessary to advert to the well known fact, that artificial light, when confined within narrow bounds, shortly becomes languid, and much inferior to a light situated in open space. The reason is, that in the former case, the decomposition of the air by the flame bears a large proportion to the quantity contained. And for further illustration of the excellence of the improved Lamps, it is only necessary to advert to the equally well known fact, that even a light in open space where the air is quiescent, is much inferior to that which is produced when stimulated by a current of air passing through the flame; as the increase of the light on the application of the transparent tube of Argand demonstrates: which, however, when placed within a case or lamp, to prevent its being agitated or extinguished, partakes of the general imperfection incident to all lights exhibited in the Lamps now in use, by reason of the decomposition of its surrounding air.

It is not only easy to show that the light of the Street Lamp may be raised from its present languid state to that of light burning in open space; but that it may be still further increased, in the proportion that the Argand flame, in open air, is increased by means of its transparent tube.

tube. The principle on which these advantages are attained, as practically exhibited by the improved Lamp, is perfectly simple, and may be laid down as follows: *Let the external or pure atmospheric air be excluded* from the lamp, or transparent case, *except by flowing through, and contiguous to the flame;* and let a demand for the entrance of this pure air be occasioned, and its activity excited, by the levity of rarefied air, and its propensity to ascend.

Those who retain a doubt on the subject, may have recourse to experiment, and convince themselves, by means of Count Rumford's Photometer*, of the great inferiority of light contained in a globe or case similar to that of the present Street Lamp, when compared to the light of a burner (trimmed in the same manner), to which the air even in a quiescent state has free access. They may also ascertain the fact, and perhaps more readily, by observing the difference of the shadows given by the lights in question on a wall or white substance.

By the increase of light to be derived from the superior construction of the proposed Lamp; which it is intended still further to augment by the consumption of one-half part more oil than is consumed by the common Lamp; nearly a moiety of the number of Lamps now in use may be advantageously dispensed with.

In order to ascertain the degree in which the ratio of the light afforded by the common and the improved Lamp is in favour of the latter, let the whole light emitted by the burner of the common Lamp be called equal to 100 parts. Of these not more than 40 fall beneficially on the ground; as is obvious by inspection of Fig. 1, the lateral light being lost, and that which passes upwards absorbed by the cover. Let the non-absorbent cover of

* Described in Vol. IV. of the First Series of this Work.

 the

the improved Lamp, include an angle, equal and opposite to that which subtends the rays of light which now fall on a base of 80 feet, at the elevation of eleven feet from the ground. And even suppose such non-absorbing cover to be so imperfect as to reflect only half the rays that fall thereon; yet, by virtue of that improvement alone, the produce of light compared with that of the common Lamp is as 60 to 40: which by the proposed consumption of one half part more oil, calculating only in a direct ratio, will become as 90 to 40 over that of the common Lamp. And this again being more than doubled by the current of pure air flowing through the flame, which is the grand recommendation of the improved Lamp, the amount of light thus obtained, compared with that which is afforded by the Lamps now in use, is as 180 to 40, or more than as 4 to 1.

If, however, we estimate the increase of light which the increased consumption of oil will produce, *not* in the direct ratio, but according to the experiments of Count Rumford, whose accuracy as an experimental philosopher is universally acknowledged, the result will be far more considerable. The Count demonstrates the fact, which, indeed, is almost self-evident, that "as soon as the particles of which flame is composed are so far cooled, as to be no longer red hot, they cease to be luminous, and consequently to be visible; and they disappear entirely:" for, as he beautifully illustrates it in another place, "these particles must be considered as being luminous, in consequence of the action of the same cause, which renders a cannon-ball luminous that has been heated red-hot in the fire; and as all known bodies cease to shine in the dark at a known given temperature, (that of about 1000° of Fahrenheit's scale,) the hot particles which compose a visible flame, ought to disappear en-

tirely,

tirely, the moment they become cooled down to that temperature." And in his seventeenth Philosophical Essay, he presents us with a Table, showing the results of a variety of experiments, and evincing that the consumption of oil being increased one half, produces more than three times the light: but this extraordinary advantage cannot be obtained through the medium of the Lamps now in use; which, on account of the deficient supply of oxygen, and the rapid decomposition of the air, are so far from being capable of beneficially consuming an additional quantity of oil, that even a great proportion of their present supply is productive only of smoke and fuliginous matter.

If, then, one half part more oil will afford three times the light, or in the proportion of 120 to 40; and even if the non-absorbing cover, peculiar to the improved Lamp, be supposed to reflect only half the rays it receives, the light becomes as 180 to 40: this ratio, by the introduction of a uniform and rapid succession of pure air through the flame, as is proved by the application of the Argand tube, gives much more than a two-fold intensity; that is, at least as 360 to 40, or as 9 to 1 in favour of the improved Lamp.

It is conclusive, from the reasons and facts above adduced, that if the number of Lamps now in use within the Bills of Mortality, amounting to about 50,000, be reduced one half; or, in other words, if, for 50,000 common Lamps now in use, we substitute only 25,000 of the improved Lamps; there will still be afforded in the vicinity of each Lamp, more than 9 times the light, and a general diffusion of more than four times the light that is now produced.

By a due examination of the principles on which the improved Lamp is constructed, and still more satisfac-

torily

torily by actual observation of the incomparably pure, beautiful, and brilliant light which it affords, the public may be convinced of the utility of the invention.

The proposed reduction of the number of Lamps (with the exception of corner Lamps) to only half the number now in use, would diminish the quantity and expense of breakage in the same proportion; which would be still further decreased by the strength of the globes, which being only half so deep as those now in use, are four times as strong; and by the security of the oil-holder, and from their being so constructed as to render the necessity of cleaning less frequent, and the operation more easy. The original cost of the improved Lamps necessary to illuminate a given space, would be less than that of the Lamps now in use; and the aggregate consumption of oil would be diminished, while the light is increased. Hence it is evident, that by a general adoption of the improved Lamps, the public would not only derive the benefit of a superior illumination, without additional charge; but, contrary to their usual experience of exclusive privileges, by patent or otherwise, would also, in this case, derive the farther advantage of a very considerable diminution of expense.

The improved Street Lamps, and Lamps of various applications, (in which the improved principles are introduced,) viz. Convoy, and Marine-Signal Lamps, Carriage Lamps, Reading Lamps, Magic Lanthorns, &c. and also Globes and Vases for ornamental purposes, may be seen and examined, by those who prefer ocular demonstration, at Mr. Brooks's, No. 110, Strand, opposite Exeter-change.

Application

Application of Larch Bark, to answer all the Purposes of Oak Bark, in Tanning Leather.

By THOMAS WHITE, *Esq. of Woodlands, Durham.*

From the TRANSACTIONS of the SOCIETY for the Encouragement of ARTS, MANUFACTURES, and COMMERCE.

The Lesser Gold Medal was voted by the Society to Mr. WHITE *for this Communication.*

IN the year 1786, my deceased father did himself the honour of laying before the Society of Arts, &c. his remarks on the improvement of this place; and in a second letter, in 1796, he wrote some further observations; since which time, the plantations, as well as the place in general, have made great progress in beauty and improvement, which induces me to trouble you with a few ideas, that I flatter myself will be of importance to the country at large, as well as of private benefit to persons in possession of woods, which you will oblige me by laying before the Society.

As the trees have now advanced, as I have before observed, to a considerable size, we have been busy for some years in weeding them out to a timber distance; in doing which, lately, and whilst taking off the bark of some larch trees that were wanted for building purposes, our agent observed the nails of his fingers to be stained, which induced him to think, that the bark of this tree might be useful in tanning leather, a thought that struck the active mind of my father many years ago, when he was desirous of trying its virtues in this necessary and useful business, but was prevailed upon to give up the project, on being told, that a tree containing turpentine would not answer the purpose, his advisers thinking the larch

larch was a species of the fir tribe, instead of the cedar. In consequence of this renovated idea, I was determined to have the most impartial trial made of the bark of the oak, and that of the larch; and in order to shew the latter no favour, I procured some of the best oak bark in the country, such as can rarely be purchased, and took that of the larch from a small young tree. I next purchased two calf skins, of the same value, weight, and quality, and put as much of the fine oak bark to one skin, as was applied of the larch bark to the other, both remaining in the pits the same time. During the operation, as we repeatedly weighed a certain measure of larch liquor against the oak, the latter always required an additional quantity to make the scales equal, which accounts for the skin tanned by larch being above one pound and a quarter heavier than the other, which it was when dried and ready for the currier, the increase being gradually perceptible during the whole business. Which of the two skins proved the best, I leave to the Society to determine, but I flatter myself that, exclusive of the additional weight of that produced from larch, the colour of it is preferable for gloves, saddles, boots, &c.

As I am proceeding with some other experiments, one of them will, I hope, prove which of the two infusions that the skins were tanned in, will afford the greatest weight of leather, in order to produce a fair test of the intrinsic value of both trees, when applied to tanning; the result of which I shall do myself the honour of laying before the Society at a future period.

It must be observed, that the bark of oak and birch, (the two kinds used to any extent), can only be taken off the trees for a very few weeks; whereas larch bark may be collected at any period during three parts of the year; and, I believe, with almost as good effect even in winter;

winter; and as the bark is stript off this tree with very little trouble, the expense of doing it is much less than the oak. It is unnecessary for me to inform the Society, that as oak is daily decreasing in this country, so as to require a great annual importation, the larch trees (which I believe there is little doubt of being the cedar of Lebanon) is in a fair way to be as celebrated hereafter, as it was in former times.

In my professional exertions of laying out grounds, and planting by contract, I am constantly regretting the mischief done to woods, by the want of thinning them, which some of my employers tell me they neglect doing from the difficulty of finding sale for the weedings, which the probable source of consumption for the larch bark, will, I hope, entirely do away, and that this valuable species of tree, by being left at proper distances, will arrive at such perfection, as to be fit for most purposes, if not all, that oak is applied to, viz. in ship-building, &c.

It is my intention (if my professional pursuits will admit) to publish a small treatise on the management of woods, in general, collected from the practice of my late worthy father and myself, that I hope will be found useful.

I have sent, from Durham, by the mail coach, directed to you, in a paper parcel, the two skins, with specimens of the oak and larch barks, used in the process of tanning them; and also the currier's letter who dressed the skins, which, however, he does not think is to be laid before you.

I am sorry that I have not been able to send before, two pieces of leather, of a strong quality, tanned with larch bark, and which, though perfectly useful for most purposes, would have continued to great advantage some time longer in the tan-pit for making soles of shoes.

 With

With the specimens, I send a pair of gloves, and a remnant of leather, converted into shoes, both tanned with larch bark, by a person at Hexham, who told me that glovers would use nothing else, could they get a sufficient supply.

In addition to the equality that larch bark is upon with oak, in regard to its tanning as great weight of leather of every description, it has the advantage of being *quicker* in its operation, and from its light colour, of being *preferable*, as mentioned before, for gloves, book-binding, &c.

It must be observed, that nothing has been introduced into the tan-pit to make leather firmer but bark.

The leather has not been five months in the tan-pit.

Since I did myself the honour of sending to you, on the 26th ult. a parcel of leather, by the Charlotte coach, I am informed, that during my absence from home, and after you had done me the favour to request a specimen of strong leather, my tanner, to expedite the work, had applied occasionally warm water, in cold weather, which may have made the leather less firm than it would otherwise have been; the time that it was in the tan-pit, also, did not exceed four months. If you, therefore, think the leather is not sufficient to pass judgment upon, I will, when my strong hides are ready, send you a specimen of much superior quality. Mr. Curwen has just written to me for some leather, to whom I mentioned the disadvantage it laboured under.

After sending you the two first skins, I put a number of others, of equal weight and quality, into each of the two tan-pits, to try which bark would prove superior in the end, and found, on taking out the leather, on the same day, from each pit, although both were equally well tanned, that the larch liquid was the strongest, but did

not,

not, as in the first instance, produce much more weight of leather than the oak.

The Society wishes to know the comparative expense betwixt larch and oak barks, in a given number of hides.

I have not yet sold my bark from the larch tree, therefore it is not in my power to answer this question; but as it tans faster, and will probably be at a less price, it certainly will be found an excellent substitute for oak.

A tanner in this country has produced some very firm leather, with larch bark, by making it undergo the additional process usual for that purpose; but my skins acquire the solidity they possess by the strength of the bark alone.

The longer I try the larch, the better I am pleased with it: and I am certain, that when used in an extensive way, by people that have proper tan-pits, &c. it will increase in reputation very much, and be found far more beneficial than I have been able, in my limited scale, to prove it.

The leather is sent off this day for you, in London, Nov. 21st, 1812.

I have enclosed a certificate, as strong as I can make it, and shall send Mr. Mackintosh, in the Haymarket, on Tuesday next, a calf-skin, one half tanned with oak, and the other with larch; and a hide the strongest I have at present tanned with larch.

I do not wonder at John Bull's unbelief, but I hope, in a year or two, hundreds will prove my tanner's testimony correct.

Certificates.

I, Thomas Farbridge, Tanner, of Woodlands, in the county of Durham, do verify, on oath, before one of his Majesty's Justices of the Peace, that on or about the

21st of June, 1811, I put a calf-skin, weighing, when green, 12lbs. into a tan-pit, to which at different times I applied 43¼lbs. of larch bark; and on the said 21st of June, I put another green calf-skin, of the weight of 12lbs. also, into another pit, and in the same manner applied, at different times, 42lbs. of oak bark, and on one and the same day drew both these skins, when tanned, which, when dried, produced as follows: viz. the larch skin 6¾lbs., and the oak 5½lbs., both skins undergoing exactly the same process, and the former having neither oak bark, nor any other substance of tanning quality put into the tan-pit, but larch bark. And although the larch liquor had 1¼lbs. more bark than the other, it was infinitely stronger; for after the two skins were tanned, I put three sheep skins into each of the pits, and although I drew the three from the larch liquor about twenty-one days before those put into the oak bark, they were in a better state; and, at the end of this second tanning, the larch liquor was the strongest, as I have ever found it to be after every experiment where the weight of leather was equal.

I moreover declare, that the skin which is on the point of going to London, the one half marked oak, and the other larch, was tanned, after being equally divided, one with 43lbs. of larch bark, and the other with an equal weight of oak bark, being put into the tan-pits on the same day, about the 21st of May last, and drawn together about a month ago; and that nothing of a tanning quality was put into the larch-pit, but larch bark alone, and the process exactly the same in regard to each half, as in the first experiment.

I moreover declare, that the specimen of hide leather sent to London in November last, as well as the hide now to be sent, although tanned in a pit with a number

of

of others, underwent exactly the same process, without any bark or mixture but pure larch bark, and although no comparison was made betwixt it and oak, I am certain it would have required as much bark of the latter to have produced leather of equal good quality and weight.

I, Thomas White, of Woodlands, in the county of Durham, do verify, on oath, that to the best of my knowledge, what Thomas Farbridge attests is true; and as I have often, daily, and sometimes several times a day, inspected the tanning process, it was almost impossible that any deception could be practised without my discovering it.

I am convinced that the trial of the larch bark will bear the most minute inspection, and will answer all the purposes as a substitute for oak bark. The process of curing is in general ten or twelve days, and these specimens were done in twenty-four hours.

THOMAS GRAHAM, Currier.

Hexham, Aug. 6th, 1811.

The Honourable Sir James Steuart, of Courtness, called at the Society's house to give testimony in favour of Mr. White's method of using larch bark, for tanning; he had sent one ton of the bark to Mr. Halden, tanner, at Hamilton, whose report is much in its favour, the operation being performed in less time than when done with oak bark, and better in colour, quality, and weight.

In a letter from Mr. W, to the Society in answer to enquiries, he says, it is with great pleasure indeed, that I answer your questions, whether the bark of the

larch

larch continues in favour with the tanners? one of whom, a customer of mine, who deals very extensively in the trade, has not, I believe, used much oak-bark this season, and probably will not, should the supply of larch be sufficiently abundant.—He finds such advantage in the beautiful light colour of the leather, as well as in the process being shortened, by the larch tanning quicker than the oak-bark, that I think his neighbours in another year will try to have a greater share in the advantage of using this substitute.

I take every method of trying leather tanned with it, and it has never once induced me to have a worse opinion of it than I at first entertained.

At the time I began tanning with larch bark, I tried Spruce and Scotch fir, Weymouth pine, and some other barks, all which I found would tan in a certain degree, but which were of very little comparative value with the larch; and as I supposed the weakness of the fir tribe in its timber, would be rendered still more so by taking off the bark, I have lately had an opportunity of proving it, and see that one year after, if the wood is exposed to the weather, it is perfectly unfit for any purpose but the fire, by shewing evident signs of decay; but, notwithstanding this great defect, as my first experiment in tanning with fir bark was only very limited, I was determined, on being requested by Mr. Stobbort, of Hexham, to try it, to do so on a larger scale against larch bark, which at first appeared to advance pretty equally, but I now find the leather in the larch-pit perfectly done, and that in the other will require as much more time, besides almost double the quantity of bark. As I mention the tanning quality of fir bark, I must also give a comparative statement of the expense of collecting it. Each Scotch fir affords little more than half the quantity of larch of the same dimensions,

mensions, and takes nearly double the time in peeling, which brings the expense to be almost fourfold that of the larch; as that is the case, and almost double the quantity of bark is necessary to tan the same weight of leather, it can only be an object to be resorted to on the greatest emergency, when little or nothing else can be got, and where it can be collected from wood that is only wanted for firing, as no prudent person would think of destroying his timber for the scanty supply of bark which a fir will afford.

The eleven guineas per ton, which I received last year for larch bark, I only demand this, in order to encourage the use of it; but its true value many tanners have now the candour to say is little inferior to oak bark.

Before I conclude this subject, I must beg leave to add, that, notwithstanding the great extent of plantations made within fifty years in Great Britain, unless the proprietors of land turn their attention to their increase, by filling with trees every part not convertible to useful tillage, the produce of bark will never do away the necessity of importation; as it requires such a surface of ground to go over, to meet the yearly consumption, as is almost incredible.

And it is a matter of great regret, that within the period mentioned, numbers of them are going fast to decay, from a want of being thinned soon enough, and in a proper manner; which no planter can now have an excuse for neglecting, when the tanner holds out to him, in almost every town, a sure return for his trouble and expense, in addition to the incalculable advantage of permitting the remaining trees to double themselves in value, every six or eight years, which they can only do by a liberal use of the axe.

On

On the Formation and Materials of Roads.

By RICHARD LOVELL EDGEWORTH, *Esq. F. R. S. M. R. I. A. and Civil Engineer.*

From his ESSAY on the CONSTRUCTION of ROADS and CARRIAGES.

VARIOUS forms of roads have been suggested to the Committee of the House of Commons, upon plans totally opposite to each other; some prefer convex, some concave roads; others propose to divide roads into two or more parallel paths, with a channel between them to carry off the water, hoping by these means, to give to each of these roads such convexity as to ensure the descent of the water from the surface of the road; but in all these schemes for carrying off water from roads by the inclination of the ground, it seems to have escaped the attention of those who proposed them, that no lateral inclination of the ground, consistent with the safety of carriages, would empty a rut of three inches deep. So far from this being the case, whoever attends to the fact will find, that even down a moderate slope, where any dirt remains upon the road, the water will be obstructed. This circumstance would prevent the accomplishment of a plan, which had been proposed for making roads in alternate risings and descents: for unless such a road could be actually washed by flooding it, the effect of water lying on the road would still remain.

Roads become dirty principally from two causes; from the clay and mud brought upon them from the adjoining fields and ways, or from softer parts of the road; and from the attrition of the roads themselves. The dust thus produced mixes with rain, and becomes sludge: the wheels of carriages, though they may not actually form

form ruts in the road, throw up this sludge in various directions, so as to dam up the water, and to prevent it from running down a slope even of two degrees, which is the utmost inclination that should be permitted on a mail coach road.

In fact, roads become dry by evaporation, and where they are exposed to sun and wind, the effects of heat and ventilation are more powerful than any surface drainage, that could be accomplished. The legislature has enacted excellent laws to promote this object. They have limited, in several instances, the height of hedges to five feet; but this limitation is neglected or evaded. Even were it strictly adhered to, it would not be sufficient for narrow roads; the hedges would be still too high, for it is the sweeping power of the wind, which carries off dust in dry weather, and which takes up moisture in wet.

Mr. Jessop, page 120 of the first report, for 1808, of the Committee on the Highways, proposes flooding roads from time to time, to wash off the sludge, and to deposit whatever grains of gravel may have been mixed with it.

There are places, where this may be conveniently effected, but they do not often occur; and even where they do, it would require great care to have it permanently attended to. Besides, frost might produce very dangerous consequences. Upon the whole, therefore, it may be concluded, that a road need have no more curvature, than what will prevent it from being worn hollow, before it can be conveniently repaired.

It is obvious that roads ought to be wide and strong, in proportion to their vicinity to great towns, mines, or manufactories. As they approach the capital, they should be wider and stronger than elsewhere. When a number of roads leading to a great city combine and fall

into one, the road from that junction should be proportionably solid and capacious. Near the capital, the width of roads is however often restricted by buildings, that cannot with propriety be suddenly removed, but every opportunity for removing these buildings, and for widening the road, should be attended to, and no future buildings or encroachments should be allowed. And, though in some cases it appears reasonable, to permit the erection of new buildings, and the making new plantations, nearer than thirty feet from the centre of a road, upon condition, that security should be given to the public for the constant preservation of the road, that is thus injured; it is, however, far safer to prohibit what is injurious to public convenience, than to compromise with individuals. Cases of private hardship may, and must occur, but it is part of the true glory of Britain, that there exists no exemption in our laws, in favour of the rich.

Proportioning the breadth of roads to the traffic for which they may be employed, is not sufficiently attended to. In remote places, where there is but little traffic, the waste of ground occasioned by superfluous width of roads is an error of considerable magnitude. There are many places, where roads of twenty feet breadth would suit the public convenience, as well as if they were twice as broad.

Now it is clear, that if a road is one pole or perch wider than is necessary, there is a waste of 320 perches in a mile, equal to two acres of ground, which, at the rate of three pounds per acre, *would, if the road had been once well made, keep half a mile of such a road, as is here alluded to, in good repair.*

Before any road is begun, the nature of the ground should be carefully examined.

If

If it is to run upon the side of a hill, it is better, according to the advice of Mr. Gordon (in the first Report for May, 1808), to slope the roads towards the hill, than towards the descent.

Where roads run through marshy ground, the substratum must be laid dry by proper drainage; and where the road is liable from the flatness of the country to be at times under water, the expense of raising it above the water must be submitted to in the first instance. Temporary floods have been stated as a serious objection against lowering mail and stage coaches. This is saying, that the limbs and lives of the people of a whole nation should be in hourly danger, in every part of the empire, because in a few places the roads for a short distance are under water.

All drains for carrying off water should be under the road, or at the field side of the fences, and these drains should be kept open by constant attention, and should be made wide at the outlet.

Where the substratum of a road is *unsound*, it should be covered with faggots of brushwood, with the branches of fir trees, or with furze and heath. Flat stones, if they can be had, should then be laid over the faggots, and upon them stones of six or seven pounds' weight, and lastly, a coat of eight or ten inches of pounded stone. The pounded stone for all roads should be broken by weight or measure, and should be conveyed to depositaries on the sides of the roads, entirely out of the reach of carriages. Thence they may be carried in light barrows with *narrow* iron wheels, to the place where they are wanted.

If a pole of the road to be covered with stones is thirty-three feet wide, it will contain something more than sixty square yards, which will require about fifteen cubic

yards of broken stones, supposing that the sides of the road may be weaker than the middle. One cubic yard of well broken lime-stone weighs nearly one tun, and at three shillings and sixpence per yard, fifteen cubic yards will cost about two guineas and a half. The cost of spreading the broken stones on the road is inconsiderable, but the expense of carting them from the pit, and the price of the stone, must depend on local circumstances. The depth of broken stone here mentioned is sufficient for any road; two thirds of the quantity will make an excellent road, at a distance from any great town. No covering of any sort should be laid on the pounded stone, except clean *angular* gravel, that may insert itself between the interstices of the stones; but no more should be used than what will thus sink to a level with the surface. If the whole were covered with gravel, it would be impossible to discover the defects of the road, till it might be too late. No stones larger than an inch and half diameter should be suffered to remain on the road; where much inaccuracy in this respect is suspected, an iron ring may be employed as a gauge. In all cases, after the road has been covered with stones, it should be carefully examined, and every stone that is too large should be picked off to be broken smaller.

Where flints can be had, they are, when broken, the best common materials that can be employed; round gravel, and round pebbles, unless they are broken, never make a tolerable road.

In breaking stones for roads, the best method is to have them broken by persons sitting, and using small hammers. A hard stone should be used as an anvil, and the stone to be broken may be advantageously held in a forked stick. Attempts have been made some years ago, to break lime-stone for roads, by the force of horses,

wind,

wind, and water. Stampers, shod with iron, and raised by proper mill work, were employed; they were let to fall upon blocks of whin stones. These mills were found profitable for breaking lime-stone to powder, as a manure, where fuel was scarce, but they crushed the stone to dust rather than to fragments; if lighter stampers were employed they frequently failed to break the stone. Feeding the mill was also found difficult and dangerous. This unsuccessful attempt should not discourage mechanics from farther trials. Stones previously broken to the size of five or six inches, might be thrown upon a strong circular horizontal grating, made of cast iron. The stones might be forced downwards through this grating, by an iron runner on an edge; they would thus be broken to fragments that could not exceed a certain size, and that would not be reduced to powder.

Such materials as these are sufficient for all roads, which are not immediately near the capital, or some great manufacturing town. For roads in such situations, paving is the only certain method, yet known, that gives sufficient hardness, smoothness, and permanency to a road; and as these depend upon the choice of materials, and upon the manner in which they are arranged, pavement should not be trusted to ignorant workmen. As nothing particular upon the subject of paving is contained in the reports of the committee, it may perhaps be useful to insert the substance of what has been published in a memoir, by M. Le Large, in the third volume of "Les Machines Approuvées" of the French Academy. The following summary contains whatever is essential in the memoir, with some additional matter.

TO BE CONTINUED IN OUR NEXT.

On

On a Mode of training Vines,

By Mr. Jos. Hayward, *of Wilton, near Salisbury, Wilts.*

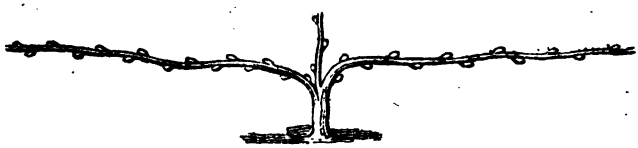
From the Transactions of the Horticultural Society of London.

I MUST first state, that I have no pretensions to literature, my occupation and habits, as a woollen manufacturer, affording little leisure for extensive study or reading; and that Hitt on Fruit Trees, first suggested to me the following mode of training Vines, the value of which you will readily appreciate.

Previous to training any tree, for the purpose of obtaining the greatest quantity of fruit, its mode of bearing should be considered, and the object of the cultivator must of course be, to obtain the greatest quantity of bearing wood, equally and properly distributed. The vine is a creeping plant, throwing out the most luxuriant shoots at the extremity of its branches, whether these are laid horizontal or perpendicular. In training this fruit tree, it is necessary to keep three main objects in view: First, to cover the space allotted to it with fruit branches, leaving room for both ripening the fruit and the branches that are to bear fruit the succeeding year. Secondly, to take of the top of each branch bearing fruit, the third joint above the uppermost bunch, except such branches as are destined to bear fruit the next year, which latter must be duly exposed, and by no means topped; for if the sap is checked in these, many of their buds will burst the same season, and the fruit for next year be destroyed: Thirdly; to take off all collaterals as they arise, and any shoots, which, though laid in for fruit, turn out unproductive, that the whole strength of the tree

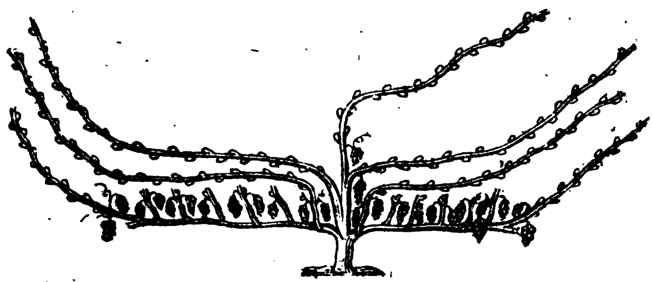
tree may be properly applied. The better to explain the manner in which this is to be effected, I must refer you to the annexed drawings, for the present saying nothing as to soil, &c.

Let a stock be properly planted so as to produce three shoots of sufficient strength and age for bearing, and this will be considerably forwarded by rubbing off all but three buds early in the spring, and keeping down all collaterals, &c. during the summer; fastening the branches occasionally, so that they may not be topped. In October or November these branches should be cut and nailed, as here represented:



A

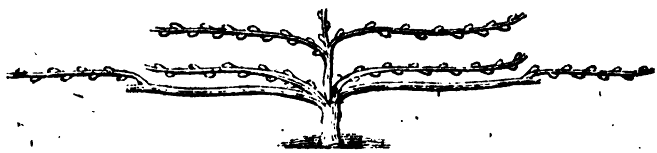
The branches to be left from three to twelve feet, according to the strength of the plant, the middle branch to be shortened to three strong buds only. The following year each bud may be expected to throw out shoots bearing two bunches of grapes, and present this figure:



A 2

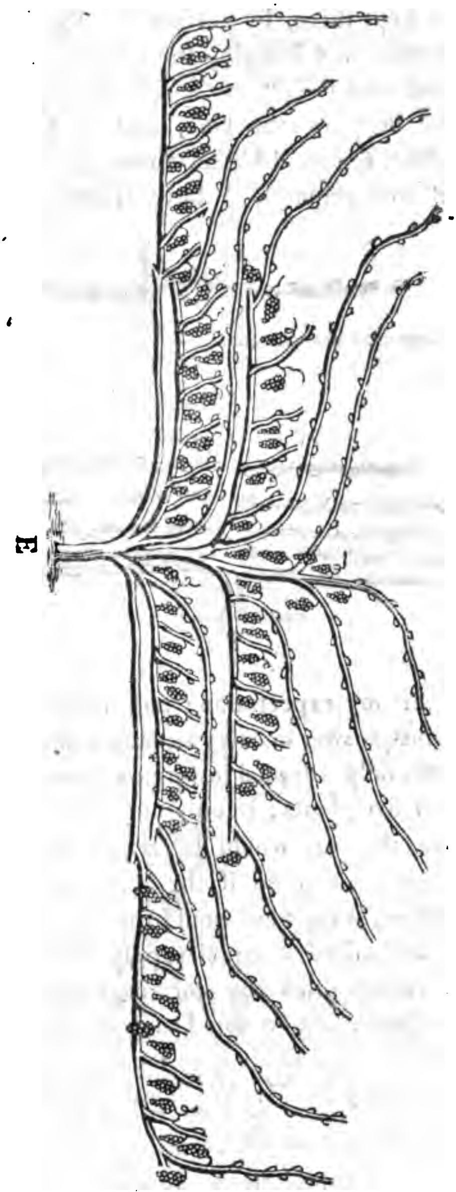
All the branches shooting from the lower stems, as shewn in the figure, should be fastened until about Midsummer, when

when the lower branches should be topped, two joints above the uppermost bunch, and the remaining branches, which are seven in number, should be fastened as they grow, and carried on in the most exposed part; then the bearers being topped, and all collaterals rubbed off, those branches will of course receive the full strength of the wood sap, and be in the most perfect state for fruiting next year. The winter following, let all the branches which bore the fruit be cut off close to the old wood, and those which are selected for the next year be shortened to their proper length, and fastened down close to the old wood, to reach to the commencement of the young wood, continued from the extremity, as represented in the following figure:

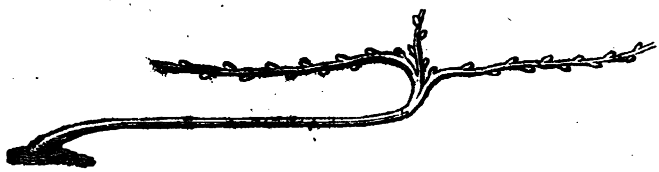


B

The two branches which bore the fruit will then be covered with young wood, which will fill the same space with fruit the next, as those did the last, year; and the young shoots being fastened close to the old, will take very little additional room: the other branches are to be laid parallel with the first horizontals, at the distance of from twelve to eighteen inches, and kept in the same manner as those the first year. In the following summer the tree will be as in E; and if kept as directed for A 2, will with its addition be as B; the new wood being laid horizontal, as before. Thus it is obvious the tree may be continued to any extent its root will supply, and every part of the wall covered with fruit the last, as it was the first, year. When the tree has gone the length allotted, it


E

it might be kept there, by cutting out the lowest horizontal branches, and bringing the others in its place. I am of opinion that the greater length the sap has to pass through the body of the vine, and its branches, the more abundant, fine, and higher-flavoured, will the fruit be, and on this principle I have trained them, as F,



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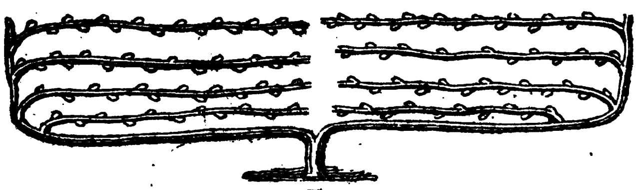

F

and it answers my expectation; and if this principle is correct, it must answer in every situation, and contrary to the mode generally adopted in forcing houses, of crowding in four or five plants; if only one root was made to fill the house, the crop would be larger and more certain, more particularly so if the root and trunk were within the house, as the fluid would then be put in regular circulation, and afford an equal supply to every part of the tree. I cannot think the soil recommended by Mr. Speechly the best; but on this I may be better able to speak hereafter. The mode here recommended will afford an opportunity for Mr. Williams's practice, without injuring the next year's crop of fruit.

Application of the Heat (that escapes through Chimneys of the Boilers in large Establishments,) to a Ventilator and a Stove, which may be adapted to the Fabrication of Syrups, Sugar, Soap, and Indigo; to the Manufacture of sulphuric Acid, raw Soda, and Salt of Soda, of Alum, Potash, and Salt-petre, and all others where Liquids are evaporated, and the extracted Matter dried.

By M. C. Pajot des Charmes.

From the Journal de Physique.

THE art of rendering profitable all the caloric produced by the combustion of bodies, whether vegetable or fossil, has not hitherto made much progress in manufactories that are carried on by means of heat. It has been remarked with surprise, that a great want of economy in this respect prevails in most establishments of this nature. It is therefore to promote the interest of the proprietors as well as that of the public, that the fruits of the experience acquired on this subject is now offered. I have had the good fortune to find myself enabled to make useful experiments on the employment of the caloric that escapes by the chimneys of the fire-place of the boilers of manufactories. The ventilator and the stove I contrived in consequence of these experiments, and the details into which I shall enter, will shew the progressive improvements in these two inventions.

§. I. *On the evaporating Boilers.*

Previous to describing the ventilator in question, it is necessary to give an account of the system of evaporation to which it has been applied, as also of the little precautions requisite, for the preservation of the boilers that are used, and for the management of the fire. The

 apparatus

apparatus is commonly composed of three boilers, which are named the *preparing*, the *evaporating*, and the *reducing* boilers, according to the different action of the caloric upon each of them. The preparer receives the liquid that comes out of the depot or reservoir; the heat has no effect upon this boiler until it has nearly spent itself upon the two others, and which, being brought near to each other, are ranged, by the extremity opposite to their fireplace against this same preparer in the direction of its length.

The water that comes into the preparer, whatever may be its temperature, serves to feed the evaporator, from which it afterwards feeds the reducer. In this reducer is carried, to the requisite degree of concentration, the water of the different solutions of saline substances susceptible of giving crystals, when it is desired to obtain them under that form; or, when the water is reduced in it, in order to extract the salt under a concrete form. In the first case, the liquid when it has arrived at a suitable degree of concentration, is poured into cooling vessels called *crystallisers*; in the second, the solution is reduced, with very particular attention to the management of the fire, in order that the salt which falls successively to the bottom of the boiler may be removed as fast as possible, as soon as the pellicle which is peculiar to it manifests itself on the surface of the liquid, and which must be broken to hasten the precipitation of the salt, also to prevent the salt from adhering to the bottom of the vessel. The continual motion of the skimmer serves for both these purposes, and to this end it should be drawn over every part of the bottom of the boiler, both along and across it, and the salt taken away, which the skimmer insensibly brings with it, to each extremity of the part thus stirred. This double operation is particularly

cularly recommended to the person charged with the care of the boilers; for his negligence in this respect may be the cause of much loss to his master.

If the salt that falls to the bottom of the boiler, be not immediately removed, it becomes fixed there and adheres very closely, so that if the boiler be of lead, there is great risk of its melting at the part where the salt has fallen, and from that moment all the liquor is in danger of being lost in the ashes of the fire-place. If on the contrary the boiler be of copper, it becomes more or less injured or oxydised in the part that comes in contact with the salt, and is thus rendered more susceptible of being pierced in the next operation, and of losing the liquor in the same manner as the other.

When the solution from which the salt is extracted under a concrete form, is destined to be reduced all or in part, until the contents of the reservoir is exhausted, the last boiler must be reduced to dryness, at each evaporation. It will be readily perceived that great care and attention must be given to the management of the fire, as the water gradually decreases in the reducer, for at the end of the operation, the heat of the boiler alone is sufficient to dry the small quantity of viscous liquid, which the salt forms into at this period, and which must be removed immediately, as soon as the skimmer will take it up.

As soon as the reduction is finished, great attention must be paid to the cleaning and washing of every reducer that has been used; there is no better method than when the vessels are empty, to pour pure water into them, and to rub every side rather roughly with a broom, in order to facilitate the separation or dissolution of the salt that adheres to them; for it rarely happens that there is not some remaining.

If

If it is discovered after this cleaning, that there are any small holes in the bottom or sides of the reducers, or any parts wasted, although not pierced through, some solder is run into them if the vessel is made of thin lead, but if it is as thick as three, four, or six lines, the holes are filled with melted lead; the edges of the wasted parts are first heated to a certain degree with lighted coal, and afterwards scraped bright and made neat and clean.

When the vessel is composed of copper, and the damage it has sustained will admit of a few grains of solder being run into the holes; it must be cleared of the salt and the edges of the parts to be repaired, heated as above described. If the defects in the copper cannot be repaired by soldering, nails, or pieces of the same metal may be employed. In this case the boiler must be removed from its place.

If, however, the boiler be a leaden one, and at least three lines in thickness, the removal may be rendered unnecessary by sliding a cast-iron plate under the injured parts, between the boiler and the iron bars that support it, upon which by means of a hammer the lips of the lead may be brought together in order to be soldered, being at the same time brightened and cleaned as before observed. This juxta position of the lips of the lead to the cast-iron plate, and the necessity of this cleanliness and neatness, must be particularly attended to, in order that the new hot lead which is put in, to fill up the space, may not any of it escape into the ashes of the fire-place, and that it may unite intimately with the old lead. With a little care an intelligent workman may himself easily make these repairs. Sometimes the workmen in order to be more expeditious in their business, may, instead of pouring water into the reducers to detach the salt, find it more convenient to effect their pur-

pose

pose by repeatedly and gently knocking the sides of the vessel with a rounded hammer, which will loosen the salt and cause it to fall off. This method may be good, when it is presumed that that metal is not oxydated; but if that should unluckily be the case, it rarely happens that the evil is not encreased by this continued percussion.

In order that the soldered parts, whether on copper or lead, may be made perfectly secure, it is prudent to cover them with a luting composed either of the white of eggs tempered with lime or sifted chalk, or rye flour soaked, or lastly, the red luting used by braziers. The luting must be perfectly dry before the fresh water for evaporation be admitted into the vessel.

The operation of cleansing the reducing boiler, usually takes about an hour and a half or two hours, if the workman be active and experienced, he cannot be too careful, in every case, in making the bottom of the reducer clean and bright; and with this view, he must not omit to use a spunge or piece of rag to take up any remaining drops of water. It is only by the utmost attention to the state of the boilers, that he can avoid accidents from the fire and the consequent loss of the liquid.

It is essential, that the workman who manages the reducing of the liquid to be concentrated, should satisfy himself that his skimmer always touches the bottom of the reducer as he draws it along, and a little practice will soon render this easy to him; for as soon as the metal of the vessel is crusted by the salt, or that it is not in contact with the liquid, the salt that remains on it, occasions a concentration of heat which, accumulating, does not fail to oxydate or melt the metal, whether it be of lead or of copper.

I have dwelt more especially upon the accidents which

too

too often happen to the reducing vessels, owing to the oversight of the workmen, because they are almost always prejudicial to the interests of the proprietors, and likewise because it appears to me to be very useful to warn them of such as it is of consequence to prevent, since when they do take place, if they cannot be repaired by the workmen on the spot, great delay is frequently incurred while waiting for their proper artisans.

Finally, if during the operation of reducing, it is found that the liquid begins to waste, its further loss may be immediately prevented, either by augmenting the fire, if it is only a dropping or sweating, but if it is a continued stream, by letting fall upon the suspected place a little ashes or fine dust, or even some of the salt in a dry state if there is nothing else at hand, any of these matters crossing the water contained in the boiler, immediately stops the hole through which the liquid runs out. This remedy which is mostly only a palliative, gives time at least for the operation to be terminated, if it is far advanced, or for emptying out the liquid, if it cannot be continued without risk of greater damage.

As towards the end of the operation, the reducing boiler cannot any longer be supplied by the evaporator, and the preparer therefore furnishes it, in this case the latter boiler should receive all the heat. This change is effected by means of a register which shuts the communication between the reducer and the evaporator, and another register gives access to all the flame under the preparer. This alteration in the direction of the heat is not resorted to, until there is only about an inch of the liquid remaining in the evaporator, in order that there may be the less to empty out. The same operation is employed when this boiler is to be repaired or renewed.

Although

Although the care that is requisite in clearing the reducers, has not been recommended for the evaporators and preparers, as the salts are never deposited in them; it is, nevertheless, proper to examine them, after each operation, because in a length of time, foreign substances and dregs may be deposited, and injure them, and further, their cleanliness must be strictly attended to, whenever the evaporation is from a salt of a different kind from that used in the preceding operation.

It must be observed, that for the reduction of liquids to dryness, the flues for conveying the heat under the boilers, should be distributed underneath them. If on the contrary, the operation is only to evaporate and bring the solution to a concentration for crystallisation, then additional flues must be placed round the sides of the boilers, in order to carry the heat there after it has produced its effect underneath. It is evident that this particular construction requires a greater surface of ground to give room for these auxiliary flues.

It is not necessary, in order to obtain the advantages which this system of evaporators affords, that the fuel should be placed under the whole length of the reducer; the half only of the side of the fore part is reserved for the fire; and this is widened to the right and left, so that the bottom of the boiler when placed over it, can be disposed in the best manner possible for receiving the action of the flame that rises from the burning wood or coal below it, and from which the heat soon spreads into the flues upon which the other half of the reducer rests, and from thence into those that are under the evaporating and preparing boilers.

In forming the flues, which are placed as much underneath the boilers as on the sides, it is requisite that those underneath should be made eighteen inches high and

 eight

eight or twelve wide, and those that encompass them, six inches wide and eight high; but still they must be so contrived, that they may be easily swept or otherwise cleaned. To this end, at the head of each flue an aperture must be left which can be closed at pleasure, by means of a clay stopper, or even with bricks, if the joints are carefully plastered over on the outside.

The same flues that convey the heat may serve, on occasion, as recipients for the fuliginous particles proceeding from the burning fuel in the fire-place, and which are susceptible of condensing in their circulation. I have several times had occasion to profit by this species of sublimating apparatus.

Whatever may be the thickness of the reducing boilers, whether they be of lead or copper, it is proper that they should rest upon a platform composed of gratings or bars of iron, of an inch square, placed one beside the other, and leaving no interval between them; for if any space be left, if only an inch, the continual contact of the flame together with the weight of the liquid, would not fail to bend and soften the metal in those parts not defended by the bars, and the species of pocket which is thus formed, is often the cause of the complete spoiling of the boiler, by the salt settling in it and adhering to the metal. This may be easily understood, since the skimmer, as it is drawn over the bottom of the boiler, cannot, as it passes, collect the salt that has fallen into this pocket.

The expense of these gratings may at the first view perhaps appear to be considerable; but I am persuaded they will be readily adoped on considering the damage they prevent.

If, instead of placing upon the same level, the three boilers belonging to this system of evaporation, the ground

ground should allow of their being raised one above the other by degrees, to the preparer, this position will give great facility in using the solutions, the emptying of which may be regulated at pleasure, by means of a watering-pot. It may indeed be supplied by a syphon; but a watering-pot or a cock is greatly preferable. These instruments require much less attention and save much time, which is lost when the liquid is laded from one boiler to another, when they are on the same level, or that the liquid is low in them. If the liquid be acid, then the cocks should be of glass or lead, or if syphons are used, the valves should be of one of those materials.

Instead of a system of evaporators composed of three boilers, of which one, always the same, is used for the reduction, it may be so contrived, that the evaporator may alternately act for the reducer, and the reducer for the evaporator; but then there must be a fire-place under each of these two boilers, and the preparer will receive at one time the heat transmitted from the two fires.

This system may also be practised with four boilers, of which the reducer only with its fire-place, is supported by two evaporators; these three boilers placed in front bear against the preparer.

This system is only proper for reducing solutions, in order to obtain the crystallised salts, for the use of the reducer would be too difficult for extracting concrete salts. I have also had occasion to employ this, but the localities, the facility of the work, the price of the fuel, and the extent of the trade, are ordinarily the motives that induce the adoption of one or other of these modes, or their rejection.

Whatever fuel may be employed it should be watched, that the current of air which goes to the grating be brisk and uniform. It may be regulated thus by means of an

air-hole made above the aperture of the descent of the steps that lead to the ash-hole, and which is prolonged before the head of the reducer. The whole of this aperture is closed up, except the air-hole, with bad iron plates, plastered with mud; these plates are placed upon bars of iron, disposed for the purpose, in a manner sufficiently firm, to allow the workman on occasion to walk on them before the door of the fire-place and round the air-hole. A piece of iron which acts as a register, opens and shuts the air-hole according as it is necessary to regulate either the fuel or the evaporation of the liquid; by this aperture also may be drawn out the burning wood or coal, which latter, all circumstances being equal, heats much better than the wood. If the flame is not so long, the heat it produces is more intense.

In order to give more activity to the flame of the coal, it must not only be kept wet and thrown damp into the fire, but also at intervals a bucket of water should be thrown into the ash-hole. The considerable vaporisation that immediately succeeds, produces a very great disengagement of oxygen, and the flame receives from it an accession of strength for some time. This immersion, which equally cools the sides and the bottom of the ash-hole, contributes also to preserve more coolness both in the air that comes through the air-hole before mentioned, and any that may be introduced from without by any particular canal.

This advantage gained by cooling the ash-hole may be more sensibly obtained, by keeping up a constant current of water on its hearth, or at least a vessel full of water may be placed there, which may be renewed from time to time; and which might receive and extinguish the live coals or breeze that fall continually from the grate. It is more particularly in summer, on account of the softness

ness of the air, that this wetting will be found most useful, for in the winter, and when the nights of summer are cool, there is little or no occasion for it.

Perhaps it may not be out of place here to observe, that when the fire is to be lighted, the best method is to put small lumps of the coal upon chips or slips of wood, and when the coal has caught fire, then to throw small coal gently on the top.

It may be further necessary to observe, that in extinguishing the fire when the ashes are separated from the cinders, great care must be taken that they are entirely quenched before they are put aside; it is best to wet them again before they are placed in heaps, for they are liable to inflame again with the first current of air that touches them, and if a gust of wind should afterwards disperse them, they are in danger of setting fire to the premises. Accidents of this nature are but too frequent.

As in general too much attention cannot be paid to the saving of fuel, it is advantageous, when the fire-places are building, to leave, towards the place where the grating is to be fixed, several holes both above and below it, of a size fit to receive the bars. By this means when the draft of the fire-place is tried, the grating and its supports may be raised or lowered to any distance from the bottom of the boiler that is found most convenient.

In order to augment not only the celerity of the ascension of the caloric in the chimney, but also the activity of the ventilators, as much in the warm evaporation, as the cold, which will be spoken of presently, the following method may be employed with the greatest advantage if the localities will admit of it.

The ascending flue of the chimney of each set of our evaporating boilers, is backed by a similar flue descending and communicating with the ash-hole under the grate

grate by the canal destined when needful to introduce cool air from without. This descending flue is only a continuation of the ascending flue, its object is to convey to the grating, and as a fresh supply, the smoaky and volatile particles still susceptible of ignition, which have escaped combustion, and the heat of which would be entirely lost if suffered to spread in the atmosphere.

Registers placed at the two aspirating holes of the warm and cold air, of the two kinds of evaporation that will form the subject of the next paragraph, regulate the rapidity of these two currents, and the register, disposed above each preparing boiler, regulates the velocity of the smoke, and consequently the draft of this furnace; it determines besides the quantity of the smoke that is brought back by the descending flue of the chimney, under the grating, or to the space left in consequence between the door of the furnace and the grating, to which the current directs it, and where it is consumed together with the substances already on fire.

I must not forget to observe, that it is necessary that there should be a separation between each evaporating and reducing boiler, in such a manner, that the solid part under each of them, forms a sort of conduit to the air that proceeds from the apparatus. This separation or partition, which requires the application of the ventilator of which I am going to speak, is furnished with a small sliding door, which by opening facilates the lading out of the liquid, especially towards the end of the operation, and when the boilers are all upon one level.

The lower part of this aperture, which is made upon the edges of the reducer and evaporator, is covered with a thin threshold of lead to prevent the filtration, and the fall of the liquid which drops from the ladle in taking it out,

out, into any other part besides the one or other of these boilers.

It is proper here to mention that when the concrete salt is to be removed from the evaporated liquid, it is convenient to place at eight or ten inches from the extremity of the reducer opposite that of the furnace a small case or box of lead, supported by a frame of flat iron, resting on the two edges of the same boiler. This case, which is eight inches wide, is furnished on three sides with edges of lead, which are from seven to eight inches high; it is intended to receive the salt taken up by the skimmer, and to facilitate by the inclination that is given to it, the dropping of the water which the salt still contains. Its fore part is furnished with a small moveable bar, of which the two ends being in the form of hooks, keep upright the two cheeks which form a part of the edge; on this bar the workman strikes the handle of the skimmer, to shake off the salt that remains attached to it. When the case is sufficiently full, the salt is taken out of it with a cast-iron shovel, and put into a large wooden or leaden vessel, which serves for a provisional depot, until it is all ready to be carried to the drying place of the *stove*, or it may be carried there at once if desirable, or if the drying place be not too far off the evaporating apparatus. The large vessel also should always be placed in an inclined position, in order that the salt which is deposited in it, and remains for some time, may be drained of the little water that is still concealed in it.

§. II. *On the Ventilator.*

The establishment in which this ventilator was constructed was filled with boilers, which altogether composed a large apparatus, forming in itself several separate sets, similar to those above described. The mist produced

duced by the vapours arising from them, was so thick, especially in winter, and in damp and lowering weather, that the interior was quite clouded, and the workmen could not only with difficulty distinguish each other, but they could scarcely see to inspect their work.

On the other hand the dirt that was washed and detached from the timbers by the condensed vapour, spoiled in its fall both the liquid in the boilers, and the matter extracted from it; it also injured the cloaths of the persons employed in the place.

To remove these inconveniences, I caused a sort of case of light wood to be placed upon the boilers; the upper part was supported on the body of the chimney of the fire-place of each set of boilers, and it enveloped them all round like a mantle; reserving the power of opening it at the level of the tops of the boilers, by means of loose doors or flaps adapted for that purpose. From the upper part of this covering, which took a pyramidical form, rose a continuation of it, which ran up against the wall of the chimney, and this facilitated the egress of the vapour, by conducting it above the roof.

In consequence of this disposition, the place was soon purified from this cloud of vapour, which was at once both unhealthy and dirty, and which was the more speedily driven into the extra-conducting flue, owing to the surrounding air having a readier access to it; this was more especially the case when the flaps or doors of the basket, which were placed above the mouth of the fire-place, were open under the proper angle, and that those placed on the side of the boilers were shut.

The sort of current that was then established swept off the vapour with astonishing velocity.

To this advantage is added another, of which I sensibly feel the importance. It is the opportunity which this

this arrangement affords of a greater evaporation of the liquids; for I remarked that in twenty-four hours, one forty-eighth portion of the mass of water contained in the boilers had evaporated; above the product of the ordinary evaporation without this case. I must here observe, that it will be always under this view that the different experiments will be considered, which I shall here relate, and which have taken place in the heated boilers.

The promptitude with which the steam was carried out, suggested to me the idea of directing it into the flue of the chimney of the furnace of the boilers. I foresaw that the caloric in expansion in this flue would produce the effect of a powerful ventilator. This idea was realised in the following manner: I caused an opening to be made in the body of the chimney, at the part that was nearest to the lower extremity of the flue of the case, which conducted the steam above the roof of the building; I afterwards stopped up the flue nearly at the level of the aperture that was made in the chimney; I closed all the doors or flaps that encompased the boilers, and only opened those that were placed above the mouth of the furnace. The effect produced by this apparatus was surprising. The rapidity of the current was such, that a candle was extinguished in an instant at the head of the boiler.

In considering the velocity with which the air introduced under this case drives towards the flue of the chimney the steam that rises from the boilers, I soon perceived that this new disposition contributed to augment the evaporation of the liquid, since in twenty-four hours, all other circumstances being the same, I found that a thirty-sixth part of the mass of the liquid had evaporated, either by the current of air drawn under the case by the heat in the flue of the chimney, or by the action of the

the ventilator on the steam, or by the concurrence of both these causes.

Reflecting then upon that property of dry air, of saturating itself with the humid parts with which it comes in contact, a property which is augmented by the movement impressed on the air, I resolved to try this mode of evaporation in the cold way, by applying it to a set of boilers placed over a fire-place, but containing no fire during the experiment. I therefore endeavoured to produce a very intimate contact of the air that entered at the bottom of the case with the surface of the liquid.

To this end, instead of the raised and spacious case above described, I placed one of a flatted form at a very little distance from the border of the evaporator and reducer, and along their whole length; it then rose in a pyramidical form opposite the chimney; and inclined from thence towards the aspirating aperture of the ventilator.

This cover was fixed in such a way, that the inclination which was indispensable in order to cross the space left between the cover and the surface of the liquid, and the attracted air, was obliged in its passage to sweep this surface (of the liquid), and to imbibe it strongly; from thence it followed the pyramidical direction of the second part of the cover, before it escaped through the aperture made in the body of the chimney, in which the caloric in expansion acted as a ventilator.

In order that the flat part of the covering might not prevent the boilers from being repaired or changed, it was constructed in such a manner, that its length was composed of several frames which shut up in leaves, like those of folding doors or screens, and which could be taken away when needful.

The effect produced by this apparatus was exactly

what

what I foresaw, for I found that in twenty-four hours one fortieth part of the mass of liquid had evaporated. But this result already so advantageous, became still more so by the addition of a balance-beam to agitate the liquor, the motion of which continually changed its surface. This piece of mechanism may be put in motion either by water, by wind, or by a horse. Its effect, in this instance obtained by means of the hand, afforded a result sufficiently favourable to this experiment of cold evaporation, since in twenty-four hours a thirty-second part of the mass was reduced.

I attempted to apply this balance to the process of warm evaporation, but the result was not so remarkable as I was led to imagine; not more than a thirtieth part had evaporated. It appears that the liquid, cooled by the agitation, was proportionally retarded in the evaporation.

On further reflecting then on this property, which dry air so eminently possesses, of seizing the aqueous parts with which it is put in contact, I attempted in the small way what is frequently practised in the large way in salt works, by means of faggots of thorns in some countries, and with ropes in others.

In the following manner I imitated the art of employing ropes in the evaporation of the solutions, and I regulated the operation by associating with it the action of my ventilator. In the place of ropes, I used slips of osier, as being more capable of resisting the liquors whether acid or caustic, and as being besides more proper for preserving to the evaporating surfaces their first vertical position, and also the distances between them.

On the other hand, instead of raising the liquid as is customary, in order to let it fall upon the ropes that are disposed for evaporating it, I used an inverse process,

 plunged

plunged my evaporator into the liquid, and raised it afterwards, with all that it had imbibed, to expose it to the dissolving action of the air, introduced under the cover of the boilers.

This new method having put me to the necessity of raising the covers placed near the boilers, I judged it convenient to fix them four feet and a half above the edges, that at the time of taking out the evaporator, there might be a distance of about three feet, susceptible of being run over by the liquid escaping from the slips of osier, as well as from the meshes of the same material which were tied between them, and which the attracted air, in directing itself upon the liquid, remaining on the osier slips, and on the drops which fall from these meshes, had time to produce its effect, both upon the droppings as they fell, and on the slips and surface of the meshes as long as the instrument is raised.

TO BE CONCLUDED IN OUR NEXT.

Account of an Hydrometer to be used as a Test in refining Sugar. By M. GUYTON MORVEAU.

With an Engraving.

From the ANNALES DE CHIMIE.

FOR a long time no other test was known for the proper degree of boiling sugar but that which is called proof by threads, *(preuve par filets,)* and which consists in putting a drop of the liquor upon the thumb, and in drawing away the spatula, observing, at the same time, if the thread rises after the rupture.

This practice having been described in some instructions relating to the art of refining sugar made from beet root,

root, M. Guyton Morveau thought it might be useful to recal to mind the instrument which he proposed more than thirty years ago, in order to render the test infallible, and experience has since confirmed its advantages.

An extract from his notes on this subject appears to us to merit a place in our Annals.

"The degree of boiling," says the author, "for obtaining sugar has so much influence, both on the quantity of the product and its quality, that, according to the excellent experiments of M. Proust, the same syrup reduced by ebullition to 0.40 crystallises very quickly; that it crystallises again, but with more difficulty at 0,35; lastly, that when reduced to 0,32, it gives no more crystals. We cannot, therefore, give too much attention to the determination of this degree, especially when it tends to form the practice of a new art, since, without the observation of this condition, we run the risk of forming an erroneous and discouraging judgment of the value of the material, and the imperfection of the process.

In 1774, the proprietor of a large refinery, established at Dijon, weary of the losses which he frequently suffered, from the inequalities of his process, and scarcely hoping for any amelioration by changing the workman employed on this service, enquired of the author if it was not possible to determine the degree with more certainty, and exhibited his works to him, in order to make him accurately acquainted with the operation.

M. Guyton Morveau soon became convinced that the *proof by threads* is necessarily subject to all the vicissitudes of the atmosphere, such as the weight, the agitation, the direction of the air, its hygrometrical constitution, &c. without reckoning the irregularities of manipulation in relation to the size of the drop, which bears a proportion

proportion to the quickness of the movement, and which the longest practice will not render constantly uniform. He thence concluded, that it was only requisite they should be furnished with an hydrometer, which, by indicating a fixed degree of concentration, would constantly supply products of the same quality; and, after several experiments made in the boilers of this refinery, he gave to the proprietor an hydrometer appropriated to this object, which that gentleman ever afterwards employed as long as he continued the business. Several other refiners in France soon constructed similar instruments. In 1782 they were sent to St. Domingo, with a memoir by the author, by M. Louis Drouhin, of Nantes, and they were almost generally adopted there in 1787.

In 1792 M. Bingham carried to Jamaica several of these instruments, which he caused to be made in silver, according to a scale which the author communicated to him at the desire of the celebrated Kirwan.

In the first note, published by the author on the subject of this instrument, in which the description was accompanied by a figure, he gave it a form and dimensions suitable to the capacity of the boilers then in use; but as he soon had occasion to observe, that they could not be used in vessels where the liquid would mostly be reduced at least fourteen centimetres in height (about five inches), he altered it on this account, without making any change in the system of its graduation, which was the easier to be done because it is only on the inferior degrees of the scale that the observation becomes important, the remainder of the instrument serving rather as a handle, or, if desired, will shew the farther progress of the evaporation.

We

We shall here limit ourselves to a description of its new form, (see Fig. 4, Plate II.) after first giving a summary account of the principles on which it is constructed.

The scale of this instrument has been carried to 25 degrees, in order to represent the ordinary state of solution in which the juice of the cane, the raw sugar, and the syrup, are put into the boiler.

Experience has shewn that the point of concentration by ebullition, the most favourable to a good crystallisation, is commonly between the third and fourth degree, which determines at once both the quantity of water that the liquor should retain, and the term of elevation of temperature, which cannot be exceeded without decomposing by the fire a portion of the product.

If we wish to see how far this prototype scale corresponds with the aërometer of Beaumé, it may be shewn by calculation, as follows:

Hydrometer for Sugars.		Aërometer for Salts.
25	answers to	33
12	to	37
Zero	to	41.333.

This comparison offers an easy method of proving whether the first be faithfully executed; but it must not thence be concluded, that the latter can be substituted with the same advantage: this would be to reduce the proportion of twenty-five divisions to eight, which are already not more extended than is necessary for judging with sufficient precision of the coincidence with the level of a liquid agitated by strong ebullition.

The new form adopted for this instrument when used in refineries may be readily understood by viewing the figure

figure which represents it on a scale of three-fourths of its actual size. To give it a proper degree of strength, the centre of gravity is lowered in the direction of the dotted line *a b* by means of the ballast placed in the lower part of the ball. The upper part should be perfectly closed, in order that nothing foreign may be introduced when it is entirely plunged in the liquor.

List of Patents for Inventions, &c.

(Continued from Vol. XXIV. Page 384.)

Joseph Price, of Gateshead, in the county of Durham, Glass-maker; for several new methods of making glass. Dated May 5, 1814.

John Vancourver Jekenham, in the county of Middlesex, Esquire; for a method of painting walls of apartments, and other surfaces, by the preparation, use, and application of certain materials for that purpose. Dated May 17, 1814.

Thomas Abice Pickering, of Hackney Terrace, Hackney, in the county of Middlesex; for a method or methods for preventing the loss of parcels (containing bank notes, bank post bills, country bankers or other notes or bills payable to bearer in London or in the country) by coaches so frequently occurring. Dated May 21, 1814.

THE

REPERTORY

OF

ARTS, MANUFACTURES,

AND

AGRICULTURE.

No. CXLVI. SECOND SERIES. July 1814.

Specification of the Patent granted to John Hancock, *late of Reading, in the County of Berks, Gentleman; for an Improvement in the Construction of Carriages, and in the Application of a Material hitherto unused in the Construction thereof.*

Dated August 25, 1813.

To all to whom these presents shall come, &c. Now know ye, that in compliance with the said proviso, I the said John Hancock do hereby declare that the nature and general description of my said inventions are as follows; that is to say: The material hitherto unused in the construction of carriages is whalebone, which I apply partially, or more particularly. The wheels, the circumference, is made of ash, or other timber, and are bound with iron; the spokes are of whalebone, fastened into the wood by mortice and tenon, or by passing the tenon quite through the mortice, divided as though for wedging, and turning each half contrarywise down upon the wood, on the outside, and nailing or otherwise fastening it: the nave or box is of cast brass or other me-

tal. The axle is iron, and has a collar on it; in the centre of which a groove is turned: this collar just enters the back part of the box, on the outside of which a groove is turned with a mortice through on each side, exactly opposite to the groove in the axle. Round the groove in the box two springs are fastened with a bolt or catch formed on the end of each, something resembling those in a common door-lock: these bolts go through the mortice in the box into the groove in the collar on the axle, and are kept down into this groove by the springs. On the outside of the bolts is made a loop to pull them up with, when the wheel is to be taken off. About half way across is turned another groove, wide enough to admit the spokes across; which groove pieces of iron are let in, under which the spokes are passed, so that one piece of bone forms the two spokes; an iron collar is then put on each side of them upon the box, which fastens the ends of all the iron cross pieces, and thus these fix the spokes in the box. When the spokes are thus fixed into the wood or circumference, and into the boxes, each two of them that are formed of one piece of bone are then braced together as tight as possible, in the manner drums are strained, only with iron clips and rivets; the wheels are pushed on the axle, and are fastened by the springs pressing the bolts into the groove in the axle, as before described.

The carriage is made much in the same manner they are generally, only in gigs a piece of whalebone is put between the iron under the shafts, to prevent their breaking; and whalebone is otherwise introduced to strengthen or brace the carriage, as may appear necessary in the different forms, or on which they may be constructed. The springs are made of steel, with bone round, under, or upon them, to prevent their breaking, or of whale-

bone

bone entirely; their form also depending on the different construction of the carriages. The body has no other novelty than the occasional introduction of whalebone, their form depending upon individual fancy or convenience, or the variation of public taste. The heads, hoods, or roofs, are composed of cotton, silk, or leather, with whalebone, iron, steel, cane, or wood, to strain or raise them, constructed much in the usual way, but subject, like the bodies, to different methods to make them lighter or stronger, &c.

Although I have laid down this description, yet I do not confine myself to the construction of such carriages, as they may be varied according to the circumstances, and to the taste of the maker or purchaser.

In witness whereof, &c.

OBSERVATIONS COMMUNICATED BY THE PATENTEE.

Having a long time observed that coach-makers have provided against the very violent concussion to which carriages are necessarily exposed, by making them as solid and firm as possible, and being continually in great danger, as well as inconvenienced, by my own breaking down in bad roads, it occurred to me, that if carriages, and particularly wheels, could be made elastic, and yet sufficiently strong, to recover from occasional resistance, these disagreeable and dangerous consequences would be superseded. Finding any kind of construction with steel could not be depended on, from its liability to breaking, particularly in frosty weather, I began to make experiments with whalebone; but here I found great difficulty, from its being so apt to split: however, at length this difficulty was easily obviated, as by repeated trials I found that if the longitudinal

fibres of which the bone is composed were made fast at the ends, it became difficult to divide them; the bone, therefore, being ferriled at certain distances, and inserted in the parts to which it is attached, it is almost impossible to do it injury. My carriages, therefore, are sufficiently elastic to accommodate to the concussion, and yet stiff enough to recover. The elasticity throughout is also much more pleasant than that of steel; as I have observed that steel springs, if they are made so inflexible as to carry much weight, they recover after bending so quick that the person riding is nearly and in many instances thrown out of the carriage. Indeed, it is to this that such misfortunes must be attributed, and not to the first shock the carriage receives; I mean the recoiling of the spring occasions the jerk. Whalebone, from its being more pliant, does not recoil so quick, but simply dips, and recovers, something like the motion of a boat on the water. Indeed, the wheels going into a deep rut, or over a large stone, is scarcely felt by the person in the carriage. It is literally impossible to break the springs. I make my wheels upright; that is without dishing, as it is termed, or being set in at the bottom. It is not necessary for me to give my reasons for this, as, from the attention many gentlemen have lately paid to mechanics, they are able to see that wheels set in at the bottom, or in an oblique direction, naturally describe a circular rout when in motion, and consequently would run from each other were they not confined; the friction is therefore very considerably encreased, particularly on the circumference of the wheels, and the strain on the axle much greater. On the contrary, if the wheels are upright, they run together, and in a straight line.

I have driven my carriage, a one horse chaise, about eight months, and have in the course of that time per-

formed

formed upwards of five thousand miles, nor has it been necessary to repair it. I should observe also, that carriages made of whalebone are much lighter, and incalculably stronger than any other.

Specification of the Patent granted to JOHN KERSHAW, *of Glossop Dale, in the County of Derby, Cotton-spinner, and* JOHN WOOD, *of the same Place, Gentleman; for a Mode of preparing Flax for the Purpose of being spun on the like Machinery as Cotton.*

Dated February 10, 1814.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, we the said John Kershaw and John Wood do hereby declare that the nature of our said invention is described in manner following; that is to say: Our said invention, in preparing flax for the purpose of being spun on the like machinery as cotton, consists in separating the fibres of the flax from each other by bleaching the flax, and by afterwards either passing it between rollers, pressed together with force sufficient to separate such of the fibres of the flax as have not been sufficiently separated by the process of bleaching or beating it with hammers or beetles, or by other modes of percussion sufficient to effect the same purpose.

The mere process of bleaching flax (which we disclaim as our invention) is well known, and it is unnecessary here to specify it.

Although the flax may, for the purpose of our invention, be bleached in its raw state, or in any other state prior to its being finally carded, we prefer the following mode. We form it with the heckle into strickles, and then rove it on a common flax-rover into soft cord, con-

taining about ten ounces in weight, for every one hundred and twenty yards in length. And after forming such rovings into hanks we bleach it, and pass it when bleached through the rollers above described as often as may be necessary to separate the fibres. We then card it, draw it, and rove it like cotton, and afterwards spin it.

The rollers to be used in separating the fibres of the flax from each other may be made of any convenient diameter and length, and of any materials hard enough to effect the above purpose; but we usually make one of such rollers of close-grained well-seasoned wood, and the other of iron, of about seven inches each in diameter, and about three inches each in length, and press them together with a weight of fifty-six pounds at each end of the upper roller; and we usually pass the flax twice, or oftener, through six successive sets of rollers, until the fibres are sufficiently separated. But if the bleaching be imperfect, or if the fibres of the flax, from any other circumstance, have an unusual degree of adherence, we continue the process until the fibres are sufficiently separated. The separation may be ascertained by inspection.

Although we have described other parts of the process of preparing flax for the purpose of being spun on the like machinery as cotton, we disclaim as our invention every part of the process except that of separating the fibres of the flax from each other by bleaching it, and by afterwards either passing it between rollers pressed together with force sufficient to separate such of the fibres of the flax as have not been sufficiently separated by the process of bleaching, or beating it with hammers, or beetles, or by other modes of percussion sufficient to effect the same purpose.

In witness whereof, &c.

OBSER-

OBSERVATIONS COMMUNICATED BY THE PATENTEES.

Such is the enrolled specification of our invention; the design of which it may not be amiss thus briefly to explain.

The flax-machinery hitherto used being found inadequate to any but the coarsest yarns, the finer numbers have been consequently confined to hand-spinning, an operation in itself so tedious and expensive that the cost of any fabric dependent on it must necessarily be much enhanced; and hence chiefly the high price of linen, cambric, and lace, when compared with articles of equal texture made from cotton, or even silk, the raw material of which exceeds in value that of flax fifty fold.

To preclude, therefore, the necessity of hand-spinning in the higher numbers of flax, by adapting the article to the like machinery as cotton, is the object of the process above specified; and, in effecting this purpose, it is hoped that the foundation of a manufacture has been laid, which may enable this country, at no distant period, to meet the French in a market, hitherto their own, that of laces, lawn, and cambric.

Specification of the Patent granted to WILLIAM PARKER, *of Whitechapel, in the County of Middlesex, Oil and Colourman; for an Improvement in the making or manufacturing of Green Paint.*

Dated August 10, 1812.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said William Parker do hereby declare that my said invention consists in combining fixed alkali with mineral

mineral oxyd and precipitate of copper, and thereby producing a permanent pea-green colour, for house and ship painting, and is not liable to decomposition by salt water, which I prepare in the following manner; that is to say: Take fourteen ounces of crude potash, fourteen drachms of crude white arsenic, and boil them in two gallons of soft water, until quite dissolved; then put the liquor into a cast-iron vessel to cool and settle; draw off the liquor clear from the sediment, and put it into a vessel that will hold twenty gallons; add to it six gallons of clear soft water, cold; take one pound of Roman vitriol, and boil it in two gallons of soft water till dissolved; put the solution into an open vessel till quite cold, then to be added gradually to the aforesaid solution of fixed alkali, stirring it well all the time, which will produce a genuine green oxyd, then to proceed in the usual way of mineral green. A most essential part of this preparation is to make the mineral green without using caustic alkali, which is the general way of manufacturing it for this purpose: the caustic alkali acts so powerfully on the vegetable quality of linseed oil used in this preparation, and thereby rendering it mucilaginous.

Preparation of precipitate of copper to mix with the aforesaid oxyd; *viz.* take one pound of Roman vitriol, and boil it till dissolved in two gallons of soft water, at the same time dissolve in another vessel half a pound of the first soft American pearlash; put the solution of vitriol, boiling hot, into a vessel that will hold ten or twelve gallons; then add to it gradually the solution of pearlash, boiling hot; to be well stirred all the time. On mixing the solution together it will cause a strong effervescence; if the pearlash is good it will be enough to precipitate the vitriol, which will be known by the effervescence immediately subsiding, and the precipitate falling to the bottom

bottom of the vessel, and thereby producing a fine green colour: when settled draw off the clear liquor; then put it into bags, made of canvas, to filter, and when well drained to be laid on chalk stones, to draw a further quantity from it; then to be put into a stove to dry.

Preparation of mixing or combining with mineral substances in linseed oil: Take one pound of the genuine mineral green, prepared as herein described, to be well powdered; one pound of the precipitate of copper, one pound and a half of refiners' blue verditta, three pounds of white lead dry powdered, three ounces of sugar of lead, powdered fine; the whole of these ingredients to be mixed up in linseed oil, and ground in a levigating mill, passing it through until quite fine: it will thereby produce a bright mineral pea-green paint, will preserve a blue tint, will keep any length of time, in any climate, without injury, by putting oil or water over it.

Directions for using the said colour for house or ship painting: Take one pound of the green colour paint, prepared as aforesaid, with one gill of pale boiled oil; mix them well together; this will produce a strong pea-green paint: the tint may be varied at pleasure, by adding a further quantity of white lead, ground in linseed oil. This colour will stand the weather, and resist salt water; it may also be used for flatting rooms, by adding three pounds of white lead, ground in half linseed oil and half turpentine, to one pound of the green; then to be mixed up in turpentine spirits, fit for use. It may also be used for painting Venetian window-blinds, by adding to one pound of the green paint ten ounces of white lead, ground in turpentine; then to be mixed up with turpentine varnish for use. In all the aforesaid preparations it will retain a blue tint, which is very desirable.

 When

When used for blinds a small quantity of Dutch pink may be put to the white lead if the colour is required of a yellow cast.

In witness whereof, &c.

Specification of the Patent granted to John Hanbury *the Elder, of Bartlet's Buildings, in the City of London, Carpet-manufacturer; for a Method of weaving Carpets, commonly called Scotch or Kidderminster, by which a new and finer Texture, and larger Patterns, can be produced than by any other Method hitherto known.*

Dated December 19, 1813.

To all to whom these presents shall come, &c. Now know ye, that in compliance with the said proviso, I the said John Hanbury the elder do hereby declare that the nature of my said invention consists in a new method of weaving or manufacturing of carpets and carpeting, thereby producing an article or manufacture which I call *flush carpets* or *carpeting*; the method of weaving or manufacturing which said flush carpets or carpeting is hereinafter described, *viz.* After I have prepared a loom, in the same manner as is usual for weaving or manufacturing Scotch or Kidderminster carpeting in one thread, or two threads, or more, I proceed as follows: For a plain ground and ribbed figure; First, when I have woven as many shutes as I choose to make the rib, I raise up the contrary lash to that of which I form the figure, and the same ground plain which I had up when I wove the last ground shute; by the word *plain* throughout these several descriptions, I mean a fourth part of the warp or chain, which warp or chain consists of two coloured and two ground plains. Then I throw a shute, which I call the binding shute, which may consist

sist of thread or threads, of woollen, worsted, linen, cotton, silk, hair, wire, or any other material that will produce the same effect, or raise up one ground plain or two ground plains, and throw in the binding shute or raise up the ground and half the colours in the ground, and half ground in the figure.

Ribbed, ground, and plain Figure.

Second. When I have thrown as many shutes as I chuse to make the rib, I raise up one coloured plain or two coloured plains, or draw up the contrary lash to that of which I form the figure, and the coloured plain also, then throw in the binding shute as above.

Both ground and figure ribbed.

Third. When I have thrown sufficient shutes for the rib, then raise up one half of the chain or warp, and throw in a binding shute; then draw up the other half, and throw in another binding shute, or raise up the contrary lash to that with which I form the figure, and throw in a binding shute, or raise up the lash and one plain, throw in one binding shute, and keep up the same lash, and raise up another plain, and throw in another binding shute.

Ground and figure plain on both Sides.

Fourth. When I have thrown in as many shutes as I may want or choose, I raise up the ground plain and coloured plain I had up when I wove the last two shutes, and throw in the binding shute, or three plains in the ground and two in the figure will produce the same effect, or the webs may be united with one of the shutes that form the figure, by raising up half the ground and half colours in the ground, when I throw the coloured shute with which I bind them together.

General Directions.

First. In producing any of the foregoing articles a tail cord, or tail cords, may be dropped occasionally, but the article in that case will not be so perfect as it is without dropping a tail cord, or tail cords.

Second. In any instance where I have to draw up the contrary lashes, I should prefer an additional engine beam and box for that purpose; and when I produce the article with rising up plains only, I should prefer additional treadles, according to the number of plains I have to rise, except when black-up loom, on draft loom, or open shade loom, is used, in which case extra treadles will not be necessary for the plains. But in case of having an extra engine in the black-up loom, one engine-treadle additional will be necessary.

In witness whereof, &c.

On the Construction of Roads.

By Richard Lovell Edgeworth, *Esq. F. R. S. M. R. I. A. and Civil Engineer.*

With an Engraving.

From his Essay on the Construction of Roads and Carriages.

Pavement.

STONES in a common pavement are usually somewhat oval, from five to seven inches long, and from four to six inches broad. They are laid in parallel rows on the road, Fig. 1, (Plate IV.) or alternately, Fig. 2, as bricks are laid in a wall.

On the pavement, Fig. 1, wheels slip from the round tops of the stones into the joints between, and soon wear

away

away the edges of the stones, and their own iron *tire.* By degrees, channels are thus formed between some of the stones, and in time the pavement is ruined.

On the pavement, Fig. 2, where the stones are placed alternately, to prevent the injury to which the former method is liable, the wheel W, sliding sideways, makes a channel between two stones, and is then obliged to mount from the groove, which it has made, to the top of the stone opposite to it: when it has attained this situation the wheel may slide sideways, or may go forward over the top of the stone D, till it drops into the interstices between the two next stones. By continual wearing these ruts become so wide and deep that the wheel does not touch the stones on either side, nor does it reach the ground between them, but it bounds from C to D, thus jolting the carriage in every direction. This method is not at present in use.

In the pavements hitherto described, the stones are but of a small size; but if flat stones, of twelve or fourteen inches long, as in Figs. 3, 4, and 5, are well laid, wheels are not liable to slide into the joints; and if such stones are laid with their longest sides crossing the road, they are less liable to injury; but still narrow wheels sometimes fall into the joints between the largest stones, and having in time worn away their own edges, and those of the stones, they will act like wedges, and will displace the stones. No pavement, of the best stone that could be procured, can long resist this action of a narrow wheel. And the only effectual means of preserving pavement is, to increase the breadth of all wheels to at least three inches.

Were no wheels narrower, a cheap and durable pavement might be made of flat stones, not more than three inches square, provided they were eight or nine inches

deep,

deep, to give them reciprocally lateral support; for the tire of such broad wheels could never sink between the joints of the stones. But, in all pavement, the first thing to be attended to is the foundation. This must be made of strong and uniform materials, well rammed together, and accurately formed to correspond with the figure of the super-incumbent pavement. This has no where been more effectually accomplished than in some late pavement in Dublin. Major Taylor, who is at the head of the Paving Board, before he began to pave a street, first made it a good gravel road, and left it to be beaten down by carriages for several months; it then became a fit foundation for a good pavement. When the foundation has been thus prepared, care must be taken that each stone is at least eight inches deep, that it should bear broadly and firmly on its base; and that the whole should be rammed repeatedly, to make the joints close; the upper and lower sides of the stones should be as near each other as possible, but they should not teach each other laterally, except near the top and bottom, leaving a hollow in the middle of their depth, to receive gravel, which will serve to hold them together. This method of paving may be easily executed by common workmen, who may throw in gravel between the stones as they are laid down. It may be easily conceived, that if a grain of gravel inserts itself into holes that are in stones opposite to each other, they will *dowel* them together. It will be useful to cover a newly-made pavement with gravel, which will preserve the fresh pavement for some time from the irregular pressure of wheels, till the whole is consolidated. It should be observed, that the stones should be of equal hardness, or the soft ones will be worn down into hollows.

M. le Large, in his Memoir, has exaggerated the obstruction

struction occasioned by the wheels of a carriage bounding from one stone to another. Whenever a wheel falls and rises alternately, the *vis insitæ* of the carriage preserves the force acquired by the fall to assist it in rising again. M. le Large calculates the loss of power to a carriage rising half an inch at every paving stone to be equal to what would draw it up a hill, a mile long, and a hundred and twenty-six feet high. This calculation is certainly beyond the truth.

It is scarcely necessary to add, that in every species of paving no stones should be left higher or lower than the rest; for a wheel descending from a higher stone will, by repeated blows, sink or break the lower stone upon which it falls.

Perhaps iron pavement might be practicable. The hardest stones soon give way at the edges; but coarse refuse iron might be tried without any great expense. It should be cast with a rough surface, upon which horses' feet might have a proper hold: this inequality of surface would impede the motion of wheels but very little. Whether such iron pavement should consist of large or of very small pieces, is a question that cannot be determined without experiment. The expense would in the first instance be very considerable; but its durability might perhaps be found to compensate for a large original disbursement.

M. le Large has, in his Memoir, recommended very strongly narrow tracks of a superior kind of pavement in the nature of stone railways. He supposes, that no inconvenience would arise from the meeting of carriages on such a track-way; because, he takes it for granted, that all carriages return empty from the capital.—A supposition of a very extraordinary nature! Such stone railways have been recommended to the Committee by Mr.

Matthews,

Matthews, in the first Report for May, 1808, and were some years since, as travellers may have seen, in actual use at Milan.

It is obvious, that such partial track-ways cannot be convenient in the vicinity of a great capital.

Though railways on a common construction are not applicable to the traffic that goes on near a large city, it is yet well worth considering, whether they might not be advantageously adapted to great roads. On such roads, when they are sufficiently broad, railways might be placed on each side of the road. On these small waggons for heavy burdens, linked together, might be drawn; and carriages for swift conveyance might be received in cradles suited to railways: and thus light carriages may be transported on railways without any alteration in their present construction; so that coaches and chaises may travel for any convenient distance upon any public railway, and may turn off instantly to a common road.

Steam-engines may also be employed to draw all kinds of carriages, not by a travelling machine, but by engines placed at convenient distances on the sides of railways, which, by circulating chains, may draw all sorts of carriages, with any requisite velocity, without any interruption *.

It should be generally known, that though heavy burdens can be drawn with much greater ease on canals than on railways, yet the velocity with which they can be drawn is confined within very narrow limits, by the nature of the resistance to which they are exposed; this resistance increasing in a geometrical proportion, as the squares of the velocity, with which the moving body is impelled. Whereas on railways, an increase of velocity

* See pages 65 and 129, Vol. XXIV. of this Work.

requires

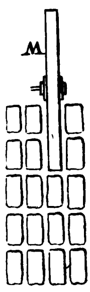

Fig. 1.

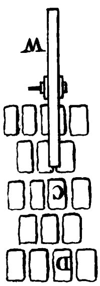

Fig. 2.

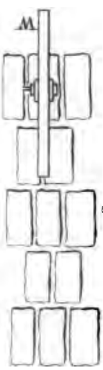

Fig. 3.

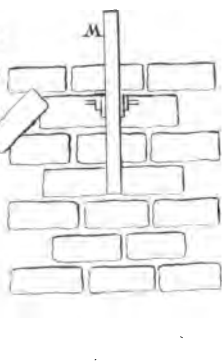

Fig. 4.

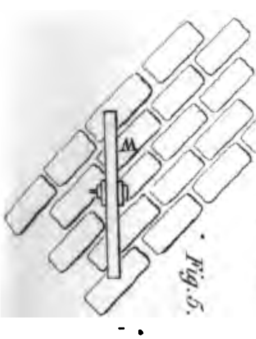

Fig. 5.

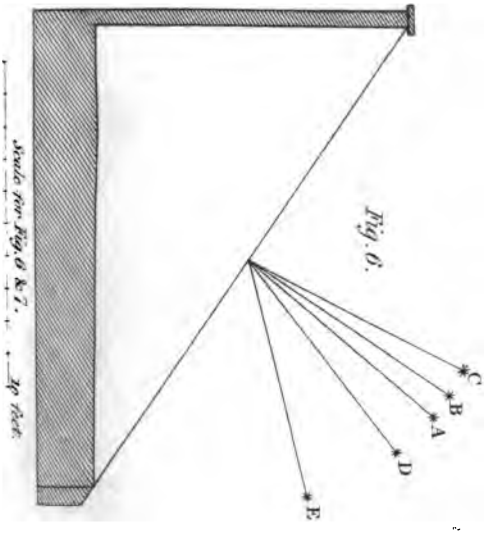

Fig. 6.

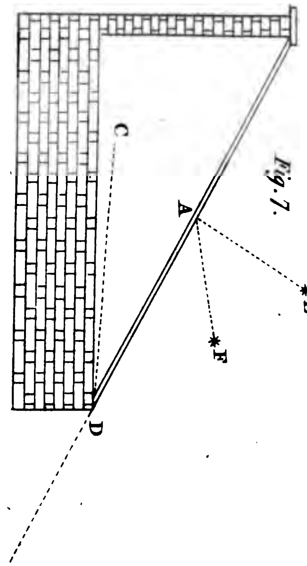

Fig. 7.

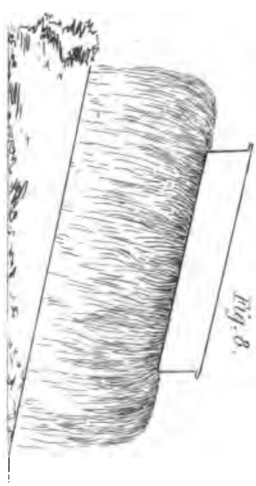

Fig. 8.

requires only an arithmetical increase of power; or, in other words, to draw a boat with ten times a given velocity would require a hundred times as much power as was requisite to draw it with that given velocity; whereas, to draw a carriage on a railway with ten times the given velocity, would only require ten times the given power. For this reason, however advantageous rail-roads may have been found for transporting heavy loads, they will be found upon trial still more advantageous in promoting expedition.

An excellent paper on this subject, by Dr. Hooke, was given to the Royal Society in 1684.

Repairs of Roads.

After a road has been made, it will for some time require the attention of the maker; ruts will be continually formed in the loose materials; these must be sedulously filled up, and a small sprinkling of river gravel should be added. All stones larger than the rest should be removed and broken smaller, and no pains should be spared to render the whole as compact and smooth as possible. At a moderate distance from the capital, if no wheels of a smaller breadth than six inches, and if no greater load than one tun on each wheel be permitted to pass on it, a road will last a long time, and may be kept in constant repair at a yearly expense of fifty pounds *per* mile.

The author speaks on this subject from large experience. By an Irish Act of the 49th year of the reign of George III. the care of public roads may, to a certain extent, be committed to a gentleman, who may appoint a deputy; the deputy receives a salary; and both he and his principal must account upon oath for the money they expend. One shilling *per* pole or perch is the sum allowed for repairs. The author has for two years not

 only

only kept in repair, but has improved eight miles, at less than one shilling *per* perch, or sixteen pounds *per* mile. This has been done by having lime-stone pounded, and laid at proper places, in the manner above described; for this he pays three shillings and six-pence, by the cubic yard, for quarrying and breaking; and as the workmen find their account in furnishing broken stone at this price, there is always a large quantity ready beforehand. Minute, but not expensive, care, has made the whole of this road like some of the best lime-stone roads in Derbyshire; indeed, no road, not even a pavement, can be harder or smoother: parts of this road will every year undoubtedly wear out; and as it is not of the breadth required by Act of Parliament, it must from time to time be new made, and widened; but notwithstanding this additional expense, he is convinced that less than fifty pounds *per* mile *per annum* will improve, enlarge, and keep the whole of this road in perfect repair for the ensuing eight years; and that after that time two shillings *per* perch will be sufficient to keep it continually in perfect repair.

Mr. Ward says, that the repair of the Kensington road amounts to above a thousand pounds *per* mile; Mr. Eccleston says, that a mile of paved road in Lancashire cost eleven hundred and fifty pounds. The eight miles of road, above mentioned as an example, are a great thoroughfare; for they are on the Western mail-coach road from sea to sea in Ireland; and besides the mail-coach, which usually carries sixteen passengers, their luggage, and the mail, there was lately an enormously heavy long coach; and, as there is no canal nearer than twelve miles, all the iron, timber, slates, and heavy commodities, of an extensive country, are carried on this road on cars, or Scotch carts.

The

The breadth of the mail-coach wheels and of the Scotch carts is nearly the same, *viz.* two inches and a quarter: and the weight which each of their wheels bears is nearly the same, *viz.* above ten hundred. A great number of other travelling carriages and innumerable cars pass daily, so that it may be considered as a fair specimen of a much frequented road.

Now, though the price of labour in Ireland is lower than in England, yet if the value of money, and the measure of an Irish and English mile be considered, they will probably compensate for the different prices of labour, and make the expense *per* mile nearly equal in both countries.

What has hitherto been said relates only to mail-coach roads. Those in the interior of the country cannot be brought to such a state of perfection for many years. All that can be done is, to hold out encouragement to those who use such roads, to pursue a steady system of improvement, which may in time give them the inestimable advantage of good roads, and of cheap carriage; and at the same time to prevent the sort of carriages, which their bad roads make it necessary that they should use, from injuring the great thoroughfares of Britain.

No local convenience should contravene the general good, no difficulties arising from narrow ways should impede the use of broad wheels, nor should the steepness of the hills in cross roads, which may require an additional number of horses, be permitted as an excuse for allowing more than four horses to enter upon the great road. Whatever additional horses may be permitted on the cross roads should be taken off when the waggon enters on the great road. And, in general, whatever regulations and indulgences may be agreed upon by the gentlemen who manage the cross roads in deep and hilly

countries, they should not be permitted to interfere with the system that governs the great roads of the Empire. On these, no hills above a certain inclination, no narrow passes, no ruts should be tolerated, no exemptions, no vexatious interruptions from weighing-engines, nothing that can interfere with an undeviating system of management should be possible. By such steady conduct the good roads would be preserved; and the improvement of those that are bad would necessarv follow.

There are many parts of England where the roads leading to great towns, from coal-pits and manufactories, are wretchedly bad. The false economy of letting such roads remain in their present condition is too obvious to insist on. Surely the demand of the commodities which is carried on such roads must supply a fund to put them, and to keep them in repair; nothing in these situations is wanting but energy and good management. But, at all events, no compromise must be made between bad and good roads. Perseverance will, by degrees, open the eyes of gentlemen and of landholders to the great advantages that would arise from the universality of well-made roads, and from the general use of such carriages as will preserve the roads in good condition.

With respect to the present modes of raising money for cross roads, the author writes with all possible deference to the customs which at present prevail. It is, however, impossible not so see that statute labour is a remnant of personal service. A gentleman might as well argue at the present day, that rents paid in kind are more easy and equitable than monied rents, as to defend the custom of mending highways by compulsory labour; commutation for this service must eventually take place, and surely it is better to reap the advantages of such a change as soon as possible.

In

In Ireland the cross roads are generally better than the great roads; and comparing all the roads in that country with the roads in England, the shameful inferiority of the latter would evidently appear.

In Ireland, by the 36th of Geo. III. the roads are made and repaired by presentment of the grand jury. An affidavit is produced, stating, under a certain form, the work requisite to be done. The grand jury *present* to the court what they approve; the judge, if the forms are properly adhered to, *fiats* the presentment; overseers are appointed, the proceedings are entered in a book, and, according to that entry, if the overseers swear an affidavit of a particular form, that the work is properly done according to the presentment, the succeeding grand jury *presents* the affidavit to the judge; the book in which the original presentment was entered is produced by the clerk of the crown; the money that was granted is entered as accounted for; and, in pursuance of this entry, the treasurer of the county is obliged to pay the overseers. This money has been previously collected by the high constables from the different *baronies* or districts in the county, in some places according to the acreable rent, in others according to certain divisions of the land into *cartrons* and *half cartrons*.

In this Act of Parliament, and in subsequent Acts, several simple but salutary regulations are enacted, which give the magistrates summary jurisdiction to enforce them. The writer of this may be excused for boasting, that, though he has been long the father of the Grand Jury, and of the magistracy, in a county in Ireland, and though he lives where six great roads meet, he has never had occasion to exercise his authority in support of these regulations.

Complaints

Complaints are made, and probably in many instances upon good foundation, that the public money thus raised has been laid out in jobs for the convenience of individuals. It is probable, that the money is sometimes carelessly laid out, and in some few instances that frauds have been committed; but still there has been no public record in this country of any such offence having been tried, and consequently no conviction upon such a charge. No human institution is perfect, no conduct is free from suspicion, or from the attacks of ignorance or malice; but when the excellent state of most of the roads in Ireland is considered, when their extent is calculated, and ther cost estimated, it will be found that this system is far superior to any that has hitherto been attempted in the empire.

Mr. Ward says, page 57, of the third Report for 1809, from the Committee on the Highways, that Mr. Middleton states the repairs of roads in England to amount to the enormous sum of two millions annually!

Half the money, well applied, would make and preserve the roads of the whole empire, so that they should be the best roads in the world.—For a full view of the advantages of such improvements in roads and carriages as may in a few years be practicable, the reader is referred to Mr. Ward's excellent report. It counts not by thousands, but by millions!

As to funds to carry these plans with regard to great roads into execution, the fairest method is the system of turnpikes properly placed. It is not just, that statute labour should go in aid of this tax; but it is perfectly just, and absolutely necessary, that the tolls at turnpikes should be sufficiently high to keep the great roads in perfect repair. To accomplish this desirable object, there must be no exemptions for the inhabitants of great towns,

nor

nor for the carriage of manure, or for any species of carriage whatever.

If the farmer pay for drawing dung to his land he has the means of compensation in the increase of its produce.—If rich citizens build country villas, they may well afford to pay for good roads to them. In short, turnpike gates should be placed at the entrances of towns so as to oblige those who make most use of the roads, to contribute the most largely to their support.

Upon the present system of exemption, a very large proportion of the tolls is remitted, under various pretences. Were all these exemptions abolished; were the tolls raised where necessary; and were the methods here proposed for making and preserving roads judiciously managed; whatever outcry might be raised at first, it would soon be silenced by the general perception of the benefits arising to trade, agriculture, pleasure, and health.

As to the repairs of cross roads, they must necessarily depend in a great degree upon the intelligence and activity of country gentlemen and magistrates, though ultimately they should be under the controul of national commissioners. Perhaps the present system of statute-labour and commutations might be converted into a pound rate, and all the long and vexatious train of penalties and indictments might be abolished by one plain Act of Parliament. A surveyor, adequately paid for his trouble, might be empowered to superintend all repairs, within a certain district, to remove all nuisances, and enforce established regulations. Such a surveyor might perhaps put the laws in force, and might by constant attendance at first, and with the assistance of the magistrates, introduce such a system of road police as would habituate the people to comply with beneficial regulations.

It

It is at present shameful to see the neglect and violation of salutary laws. Mile-stones wantonly defaced,—heaps of stones left in the middle of the road,—gates permitted to open from fields across the road,—coaches overloaded,—coachmen drunk, or insolent,—and numberless petty offences against the public, and against individuals, committed from the probability of impunity.

Offences against the excise laws in many cases meet with speedy and summary justice; may not those against the public convenience be as easily prevented?

Among the smaller arrangements, that are useful upon great roads, it has been suggested, p. 193, of the third Report of the Committee for May, 1808, that in some conspicuous part of every village the name of the place should be painted in large characters; and that posts inscribed with the names of the parishes should be set up at their boundaries. The writer proposed, several years ago, to have houses for workmen employed on the road built in the place of mile-stones. Upon a large slate, forming the front of the chimney of each house, the numbers of the miles from London might be painted, with the distance to the next stages. These *milliaria* would be out of the reach of mischief; and as slate is durable, and as paint adheres to it as well as to wood, they might be easily kept in repair. These houses would be at proper distances for the habitations of labourers employed on the road; if they were thus inhabited, it would form an inducement to steady skilful workmen to attend to this business. At present, from an erroneous charity, old and feeble men are employed by the parishes in this kind of work. These houses might be useful in various ways; they would be resorted to when accidents happened, their inhabitants might be called upon to assist in pursuing robbers. Spare wheels, harness, and tools,

tools, might be deposited in them, for the repairs of carriages in cases of accident, and they might be a check to overloading. It might be tried whether these houses were likely to succeed, by placing them at first at two miles distance from each other. Where farm houses intervene, the necessary inscriptions might be placed on stones, or on cast metal, near the ground, if the owners of the houses should make any objection to their being placed on their chimneys. Where pleasure grounds intervene, the owners might convert the public mile-posts into any ornament they thought proper.

This part of the subject, on public roads, should not be concluded without mentioning the papers of Mr. Farey, of Sir Alexander Gordon, and Mr. Abercrombie; in particular, the manly manner in which the latter speaks of the conduct of interested individuals is highly meritorious.

Sir Alexander Gordon mentions a shameful practice of planting trees, to prevent roads from being carried over particular places. Surely private interest or ostentation should be obliged to yield to public benefit. Not only the laws, but public reprobation should contemn such mean arts.

It may be of use to the reader, to have at hand a list of the several Highway Acts passed in Great Britain. They are, 13th Geo. III. chap. 78. 84;—14th Geo. III. chap. 14. 34. 57. 84;—16th Geo. III. chap. 39. 44;—17th Geo. III. chap. 16;—18th Geo. III. chap. 28. 58;—21st Geo. III. chap. 20;—25th Geo. III. chap. 57;—34th Geo. III. chap. 74.

Temporary Rudder, for the Preservation of Ships from being lost at Sea.

By Captain JAMES PEAT, *of Bloomsbury-square.*

With a Plate.

From the TRANSACTIONS of the SOCIETY for the Encouragement of ARTS, MANUFACTURES, and COMMERCE.

The Gold Medal was voted to Captain PEAT *for this Invention.*

I BEG to submit, for the consideration of the Society for the Encouragement of Arts, Manufactures, and Commerce, a sketch of a temporary rudder, invented and used by me on board of the ship Cornwall, under my command, on my voyage from this country to Jamaica, in January, 1811; which ship was engaged by the Transport Board for the conveyance of 14 officers, 200 privates, seven women, and four children, to Barbadoes.

In lat. 44° 0′, long. 19° 30′, on my passage out, I encountered a very severe gale of wind with a heavy sea, which carried away my rudder, and the rudder braces on the stern-post: I was, therefore, under the necessity of fixing a temporary one from the best materials I had then on board. On reference to a plan of Pakenham's temporary rudder, I found it impracticable to fix a rudder constructed on his plan, on account of the heavy sea to which we were exposed. It was, therefore, absolutely necessary, for the preservation of the lives entrusted to my care, that I should set about the construction of a rudder, which could be brought to act in a heavy sea, or under any circumstances whatever. This, I am happy to say, I accomplished, after a progressive improvement of fifteen days, and found this machine, when substantially fixed,

fixed, to act in every point with the same effect as the regular rudder. One of the great advantages of the rudder invented by me is, that it can be shipped and unshipped at pleasure with the greatest facility, and under any circumstances.

The engraving, No. 1, (see Plate . left in the Society's Repository,) is from a draft made by Mr. Lockwood, the Master-attendant of his Majesty's dock-yard at Barbadoes, who had an opportunity of witnessing the effect, having been aboard for some hours, when we were working the ship under all sail in sight of his Majesty's squadron lying in Carlisle Bay.

In the engraving, No. 2, (also in the Society's Repository,) is an improvement introduced in the rudder, which I found it required on my passage from Barbadoes to Jamaica, which I made in six days. The improvement consists of an additional weight suspended on a jack-stay, which is necessary to be let down when going more than eight knots an hour.

At my request, a survey was held upon this rudder by the principal officers of his Majesty's yard, and all the old masters of the ships lying at Barbadoes; who were unanimous in their opinion, that the same was a better rudder than could be procured at that island; and recommended my proceeding with the ship in that state to Jamaica, which I had no hesitation in doing.

I have had the honour to submit a sketch of this temporary rudder to the honourable the Elder Brethren of the Trinity House, who were pleased to speak in high terms of the invention, and have subscribed for twenty copies of the above-mentioned engraving for their use.

Being requested by Captain Peat to confirm and state the particulars of what I know respecting his invention

of a temporary rudder, that he had made on board the ship Cornwall, then commanded by him when on a voyage from England to Jamaica.

I lament that I am not in London, where I have some papers whereby I could give dates of particular occurrences, which I stated fully in the Barbadoes newspapers on our arrival there. However, I recollect that it was on the night of the 3d of January, 1811, that the ship parted with her rudder, when it blew a perfect harricane, and which continued, without any abatement, the succeeding day and night. When the storm subsided, Captain Peat devised a plan of making a rudder, with a spare fore-top-sail-yard fixed over the stern, and by means of blocks reefed on each side, it served as a kind of paddle. The first trial was not a successful one, for want of a sufficient weight to keep the paddle under water; but which was soon remedied, for I think that it was on the 10th of January the ship answered the helm, and we proceeded on our voyage, every day discovering some new improvements; inasmuch, that on or about the 16th, he fixed his helm to the wheel, and we proceeded the rest of the voyage without any interruption, unless it was by negligence of the man who steered.

So confident was I of the safety and utility of this new invention, that, on my arrival at Barbadoes, I proceeded in her to Jamaica, when I might have gone in other conveyances, a distance of 1000 miles.

At Barbadoes, the Master-attendant of the King's yard proceeded to sea in the Cornwall, by directions of Admiral Laforey, for the purpose of forming an opinion of the new rudder. On his return to Carlisle Bay, he declared that he would have no hesitation to sail to the Pacific Ocean with the rudder. He took a drawing of it, which the Admiral was to send to the Admiralty Board.

This

This new discovery I cannot too much praise, as being the means of once preserving my life, and the fatigue and labour which Captain Peat endured in accomplishing this machine, had nearly cost him his, by a severe fit of illness brought on by anxiety and exertions. If Captain Peat can derive any benefit from the British Government for his discovery, and of which I have bore testimony, I will add to his merits, by stating his humanity in affording comforts to 220 recruits whom he had on board, together with their wives, who were in the most deplorable situation occasioned by the storm, when the ship was unmanageable, and it being necessary to throw their beds overboard, many were sick, and received nourishment from Captain Peat's liberality.

Birmingham, Nov. 10, 1812. JOHN RICHARDS.

It having been represented to us by Captain John Peat, late commander of the ship Cornwall, of London, in our employ, then engaged in the Jamaica trade, that he had submitted, for the consideration of the Society for the Encouragement of Arts, Manufactures, &c. &c. &c. an engraving and model of a temporary rudder, invented and used by him on his passage from this country to Barbadoes in January 1811, to which place he was conveying 235 of his Majesty's troops:

We consider that it would be doing Captain Peat a great deal of injustice, were we not to give him every credit due for so valuable and simple an invention, the efficacy of which has been proved by the distance run in so short a time, and the documents we have in our possession, with the information received from many experienced nautical men of great respectability, who were aboard at the time, and had an opportunity of witness-

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ing the great ease with which the vessel was steered on the different points of sailing under all sail, and from the high terms with which it has been spoken of in this country by nautical men of the greatest experience and respectability, cannot fail of being of great utility to the public, and we consider that great praise is due to Captain Peat for his perseverance and daily improvement in substantially fitting the machine, from the idea which first suggested the construction of it.

We have received a letter from Mr. Lockwood, of his Majesty's Naval Yard, Barbadoes, accompanied with a sketch from that gentleman on the subject.

Billiter-square, THOMSON, OSBOURNE,
Nov. 12, 1812. and Co.

Gentlemen, *Feb.* 18, 1811.

I have the honour to forward a sketch of the temporary rudder, by which Captain Peat governed the Cornwall to this island.

The apparent ease with which the ship reached this anchorage, the direct course she made under a press of sail, even studding sails, and the account of its action, led me to investigate the circumstance minutely, and enable me to speak very confidently of its properties; and, in order that you may have yet more information that I have time to write, I inclose the sketch with a Barbadoes paper. It was my first intention to send the plan to Mr. Robert Blachford, Chartseller, Minories, for immediate impression, and to propose giving him a right or title to the plan, by sending me 200 copies. Captain Peat suggested the idea of my sending it to you.

I, therefore, Gentlemen, beg your acceptance of my humble labour; my sole wish was to render it public for the good of society, as, in my opinion, it not only supersedes

sedes Pakenham's rudder, which stands in such high repute, but every attempt of that nature hitherto made, and reflects the highest credit on Captain Peat for his progressive improvement upon the rude idea that first presented itself.

Yours, &c.

Naval Yard, Barbadoes.

A. T. LOCKWOOD,
Late Master R. N.
Master Attendant of
Barbadoes Naval Yard.

To Messrs. Thomson and Co.

Opinions of Officers in his Majesty's Royal Navy, respecting Captain PEAT's *Temporary Rudder.*

Captain Losack, of H. M. R. N. thinks that the simplicity of Captain Peat's temporary rudder is its great qualification, and never saw any thing so good under every circumstance; that it can be shipped in cases where Captain Pakenham's cannot; that few merchant-ships have spare caps; that every merchant-ship has the materials to form Captain Peat's rudder; that Captain Peat's method is much superior to that which was adopted by Mr. Nicholson, described in his "Treatise on Practical Seamanship," and as used by him for the Grafton and Elizabeth.

It appears to Captain Losack, that with Captain Peat's rudder a ship will tack, but not with the rudder described by Mr. Nicholson, which is a matter of great consequence.

Captain Hanwell, H. M. R. N. is of opinion, that Captain Peat's invention can be executed by any merchant-ship, and readily shipped in any weather; that Captain Pakenham's

Pakenham's rudder cannot be so shipped; and that he has no doubt of a ship tacking with Captain Peat's temporary rudder. He adds, that he agrees generally with Captain Losack in the observations made by him.

Captain Jackson, H. M. R. N. thinks Captain Peat's temporary rudder has much superiority over every other invention for the purpose that he is acquainted with; that it possesses great simplicity, and that ships of all descriptions have the means of constructing it.

That, in cases of heavy sea and bad weather, he is of opinion that it may be more easily applied than Captain Pakenham's rudder, but he thinks Captain Pakenham's rudder superior when once applied.

That Captain Peat's rudder appears to him more generally applicable to merchant vessels and small ships of war than to ships of the line; that he cannot judge with precision of its power, from not having seen it in practice, but he believes it can tack in all common cases.

Narrative of a Voyage in the Ship Cornwall from Portsmouth to Barbadoes, and from thence to Jamaica; together with an Account of the Loss of her Rudder, and the Invention of a Substitute; and the progressive Improvements thereon, the Manner it acted, and the State of the Weather at the Time. Extracted from the Log Book.

Having taken on board 225 troops for a passage out to Barbadoes, we weighed anchor on Saturday, the 29th of December, 1810, and made sail with a fair breeze at N. E. in company with the ship Cæsar, Jonathan Fowler commander. On the 30th we were joined by the ship Posthumus.

We

We carried a fine breeze at East and South East until the 3d of January, when, at 3 P. M. the wind drawing round to the Southward, and having the appearance of boisterous weather, we double reefed the top sails. At 4 P. M. very squally, brought the ship under close reefed top sails and courses, a heavy sea getting up. At 6 P. M. battened all the hatches down. At 8 P. M. the wind increasing, split the main top sail, and we shipped several seas over the weather gangway.

The wind having shifted to S. S. W. blowing a perfect gale, with a heavy sea rising; at 9 P. M. we took in the top sails and courses, and hove-to under the storm staysails, and struck top-gallant yards and masts. At midnight we had very squally bad weather, and a heavy sea running.

At three-quarters past 2 A. M. a heavy sea struck the ship under the counter, which carried away the tiller, breaking short in the rudder-head. We got relieving-tackles on, and choaked the rudder up as well as we could, (for there were no proper chocks fitted,) and the carpenter was under the necessity of chiselling the broken part of the tiller out of the rudder-head.

At day-light we observed the two uppermost of the rudder-braces under the counter were nearly off the stern-post.

At 7 A. M. the rudder broke adrift from the stern-post below, hanging only by the upper pintle on the rudder-head, (the ship steered on the upper deck). The great sea that was running occasioned the ship to labour and pitch very heavy; the rudder in consequence having so much play, began to shake the stern-post, and tear away the counter. We got a purchase on the rudder, with an intention of heaving it up to clear the upper pintle which it hung by, and then to cut it adrift; but at that moment

the rudder received another shock by a heavy sea, which broke it short off under the counter; the lower part dropping astern, we hove the upper part up, and cut it away, going altogether clear of the stern-frame.

At 8 A. M. a tremendous sea running, the wind backing round to the South East, Hazy weather, and no ship in sight.

At 11 A. M. saw a ship in the South East, distance about six miles, (supposed to be the Cæsar); hoisted signal of distress to her, but not perceived.

At noon, in lat 45° 48′, long, 18° 10′, the gale still continuing, the ship labouring very much, and making a great deal of water, all the hatches were battened down, and the dead lights in all the windows. This day no provisions could be served out to the troops.

On the 4th of January, the gale still continuing, with a great sea running, and the ship labouring in the trough of the sea very much, we set the mizen-top-sail close reefed on the cap, to keep the ship closer to the wind, having no storm-mizen. Towards night the gale increased at South East, the ship's head to the Southward and Westward. In this dreadful situation we were left without any ship in company, and 263 souls on board; it then became absolutely necessary to have recourse to some expedient for governing the vessel.

Having examined carefully a book of naval tactics I had in my possession, I found a plate of Pakenham's temporary rudder, with the description accompanied, which gave me some little hope of success: but on further investigation, it appeared to me quite impracticable to ship a rudder on that plan, if we had succeeded in fitting it, owing to the heavy sea that was running; besides which, I had no spare cap on board, and as we steered on the upper deck, the sea must have been perfectly smooth to

succeed

succeed in getting the rudder-head up the case without materially injuring the counter.

It was at this time one of the seamen represented to me, that he had been on board a Turkish frigate in a similar situation in the Mediterranean Sea, and they managed to steer the ship tolerably well under her head sails, by means of a machine placed over the quarter or stern of the vessel, (he could not recollect which), but it was made from a spare spar, with a gun-carriage fixed to the end of it.

I immediately ordered the spare top sail-yard to be got aft, and the carpenter was directed to get some three-inch oak plank, intended as a substitute for the gun-carriage; with which to form a case, by nailing it on each side of the topsail yard, leaving about two feet of the end of the yard clear, making it about four feet long and three feet deep, secured together, first on the inside with inch-plank nailed the contrary way, having a piece of three-inch oak about one foot in depth placed on the inside of the lower end of the case, to which the planks were well nailed, and the bottom part of the case leaded over, having about 28lbs. weight to keep this part of the machine down in the water. Two guys were fitted round the topsail-yard, about two feet above the case of the machine, to be brought on the quarter-deck from each quarter, to keep the machine steady,—the seaman referred to having represented they had steered in the Turkish frigate with tackles on the inner end of the spar.

Towards noon, notwithstanding the ship was straining and rolling very much, we were getting on fast with the machine. It blowing very strong gales from South East, the hatches were still kept down, and no provisions could be served out to the troops. We saw a ship in the South East, about six miles distance, scudding under

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her fore-sail. Hazy weather this day, and frequently pumping ship.

On the 5th of January we had fresh gales, with a heavy sea. We finished our temporary rudder, and got it over the stern, which we did with greater facility by means of a tackle on the end of the spanker-boom. This tackle became of the greatest service to us afterwards in getting the machine in and out, and in the event of tacking or being taken aback, to prevent the machine from going under the ship's counter. We found it impossible to steer by the tackles on the inner end of the machine, which came on the quarter-deck over the stern. Although there was at this time a very heavy sea, I ordered the machine to be hoisted up, and launched on the quarter-deck, to make some alterations which then became absolutely necessary. The gale was abating a little, but the ship rolled very much. We set the top-sails close reefed to steady her.

We were proceeding with our improvements on the temporary rudder, and as I found it necessary to steer by this machine from the outer end, and to have out-riggers on each quarter, with blocks at the ends to receive the guys or pendants through, which were fastened round the spar two feet above the case; for the out-riggers, I ordered the spare top-mast to be laid across the afterpart of the quarter-deck, and lashed on each side to the timber heads, the ends of which projected about twelve feet outside of the quarter where the top-blocks were lashed for the rudder-guys to reeve through. The ends of the guys were made fast to luff tackles, hooked on to a strap round the mizen-mast, and the inner end of the machine was steadied by lashings to the midship ring-bolts of the stern stantions.

On the above plan, we had great hopes that we should succeed

succeed in getting the ship's head round on the other tack, and all hands were employed in making the necessary alterations. At 11 A. M. saw a ship in the South East quarter, standing to W. S. W. We made all possible sail to endeavour to cut her off. At noon we were about six miles distant from the ship. The weather was more moderate, and some of the soldiers came on deck for air. The ship still continued to make a great deal of water, which it is supposed arose from the nail holes of the rudder-braces, and the stern-post being strained.

On Sunday, the 6th of January, we had fresh gales and hazy weather. We hoisted a signal of distress to the strange ship. At 1 P. M. the stranger standing towards us, we took in the head-sails, and hove-to under the fore and main-top-sails.

At half-past 2 P. M. the ship passed within hail to leeward, wore round, and hove-to at a considerable distance. We repeated the signal of distress to him again and again, accompanied with guns, but it was not till half-past 3 he filled his top-sails, and passed to leeward. The sea was too rough for a boat to be sent on bourd, but we implored him to stay by us, or tow our head round to the Westward, (the wind having backed to the North East, and we were lying up E. S. E.); but although the commander of this vessel was aware of our loss, he made sail from us at a quarter past 4 P. M. to the great mortification of every soul on board, without learning whether we were in a leaky state or in want of any supply, or where we were destined to. I have since found that this ship was named the Sally, and commanded by George Knebly, belonging to Liverpool, and bound to St. Kitts.

The rudder was finished at 9 P. M. and we got every thing in readiness to launch it on the following morning; but at daylight we made some farther improvements on

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the plan, and tried to wear ship with the stern-cable and assistance of the head-sails, but without effect.

On the 7th of January P. M. although there was a very heavy swell of sea running, we got the rudder over the stern; set all the head-sails, and wore ship, to the inexpressible joy of every soul on board. We let the first reef out of the fore-top-sail, and set the jib to assist the steerage, having at this time eighteen men employed at the luff-tackles to steer; and, indeed, she did exceedingly well under the head-sails and close-reefed main-top-sail within one point of her course each way, and going the whole twenty-four hours seven knots and a half *per* hour.

The wind abating, and the sea going down, we made more sail; the hatches were opened, and the dead-lights taken out. This day provisions were served out to the troops.

The ship made less water. We made additional securities to the stern-frame. Latitude at noon 40° 57′, longitude 18° 24′. The distance run this day 176 miles.

On the 8th of January we had fresh breezes, the sea going down. The machine answered the purpose. Set all the reefs out of the top-sails, and set the main-sail; straining less, and making but little water. Distance run 112 miles.

On the 9th of January we had moderate breezes at North West; the swell was going down. The temporary rudder answering very well, but we were still employed in making some further improvements. During the night we carried easy sail. At 10 A. M. lowered the boat, and examined the ship; found the counter and stern frame very much shattered, and the rudder-braces off the stern-post. Lat. 38° 8′, long. 19° 0½′.

On the 10th of January we had light winds from the Westward; making additional securities to the inner end of

of the machine. At 7 P. M. tacked ship, the wind variable. At ½ past 7 we were taken aback by the sudden shifting of the wind to the North West. We found the ship to answer the steerage as well as with the proper rudder. At 9 A. M. saw a strange sail in the North East quarter.

On the 11th of January we had light airs from the Westward. At 7 P.M. spoke the American brig Isabella, from Cork, bound to Philadelphia. At 6 A. M. wore ship to the Southward, answering the helm very well. Owing to the necessity of having from fifteen to twenty-five men constantly at the luff tackles to steer, I this day formed a plan for taking the purchase used for steering to the wheel; at the same time having in contemplation several other improvements on the rudder. At 9 A. M. hoisted the rudder in for that purpose. I have to remark, that ten hands can take the rudder in, and launch it on the deck in the space of three minutes, without the least risk of injury. The carpenter was employed in making some additional securities to the two middle stern stantions, by adding to them on the inside a frame made of oak, which was filled up with two pieces of four-inch oak plank, with a hole made in the centre, which was to receive the inner end of the machine about one foot in. The whole of this frame was shored up from the deck, first nailed and bolted to the stantions; one of which was broken, and was the cause of making this false frame. The machine had a sort of shoulder formed at eighteen inches distant from the inner end. This shoulder was made by cutting up two capstern-bars, and making cleats about eighteen inches long, nailed and well moulded round the top-sail-yard, as before stated, about eighteen inches distant from the inner end; which would act in the socket, when lathered and well greased, with perfect

ease,

case, chamferring or cutting away the outer part of the socket, so as to give the machine sufficient room to work from side to side in tacking or wearing (in which case it required to make an angle of only 12 degrees instead of 45, which the regular rudder is supposed to do) or up and down by the ship pitching in a heavy sea; and for the greater security of keeping the inner end of the machine firm in the socket, we had two gun tackles fixed on each side of the machine, about eight feet down from the socket, fastened round the tafrail and false frame. The guys or pendants, which were fitted on the machine two feet above the case, were now fitted round the spar in the centre of the case, by cutting two holes through for that purpose.

On the 12th of January, at 8 P. M. the machine being completed, we got it over the stern, and found, to our satisfaction, the machine acted with greater effect. At 10 P. M. brought the tackle falls to the wheel, and found it answer very well, steering with two men at the wheel, the same as with the original rudder. I must here observe, that had it not been for the assistance received from the troops under the command of Captain Cameron (who was at all times desirous of rendering any service in his power), I am convinced that our crew would have been exhausted by fatigue, from the constant attendance required at the steerage, until we brought the tackle fall to the wheel; added to which, the attendance required at the pumps. During the whole of this day we had fresh breezes at West.

On the 13th of January we had moderate breezes at N. N. W. a heavy swell from the Northward. This day we set the head studding-sails for the first time.

On the 14th of January we had light breezes. The ship did not answer her helm owing to the heavy swell from the North East.

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On the 15th of January we had light airs. The ship did not pay attention to the rudder, owing to the heavy cross swell. At 4 P. M. we got the rudder in, and added a piece of wood to the fore part of the case, and covered it over with two-inch plank, well nailed; one end of the piece being fitted into the case. This lengthened the case, at the top part adjoining the spar, two feet, reducing it entirely at the lower part of the case, which was chamferred off sharp, and leaded, as it required more weight, which made a sort of cut-water or stern to the machine; which being brought close to the spar, prevented it catching any wreck, or any thing else we might fall in with at sea, or in rivers, or roadsteads; when working ship it would prevent any ropes or cables catching it. At 4 P.M. we got the rudder again over the stern, and found it greatly improved. At 8 P. M. set all the studding-sails, and got the royal masts up.

On the 16th of January we had moderate breezes; carried all studding-sails, but not having yet sufficient confidence to carry them at night, took them in at 6 P. M. At 6 A. M. set all the studding-sails again. Towards noon very squally weather, when we took in the studding-sails. Lat. 31° 50′, long. 22° 5′.

On the 17th of January we had a strong breeze from South East, and very squally weather. In order to prevent the ship coming up in the wind, during heavy squalls, we took in some of the after sails, the main-sail, and mizen top-sail. At 6 A. M. a strong breeze, but steady; set main-sail, mizen top-sail, and top gallant studding sails, steering very well.

On the 18th of January P. M. we had frequent heavy squalls, the ship occasionally coming up to the wind from W. S. W. to S. W. and S. W. by S. We were then obliged to take in the after-sails, but carried the fore top-

mast studding-sail all night. Strong winds at S. S. E. Lat. 29° 34′, long. 25° 52′.

On the 19th of January we had fresh breezes at S. S. E. The ship having the mizen top-sail and main-sail set, and requiring a great deal of weather-helm, (going 6½ and 7 knots throughout the twenty-four hours), we were obliged at 8 P. M. to ease the ship of the after-sail. During the night we had frequent heavy squalls. At 10 A. M. got the rudder on board, and added more lead to it; the carpenter employed in making some further improvement in the machine. The ship steered herself very well by attending to the main-sheet and mizen top-sail. Lat. 28° 38′, long. 27° 53′.

On the 20th January, at half-past 4 P. M. the rudder being again in readiness, it was got over the stern, and we made all possible sail, it now steering much better than before. At day-light (a fine breeze at South East) saw two brigs in the South West, with the starboard tack aboard. We made signal to speak, supposing them to be bound for Europe. At 8 P. M. spoke the brig Faith, from Buenos Ayres, bound to London, out fifty-six days; sent letters on board; and at a quarter past 9 made all possible sail, steering very well indeed, going 7½ knots.

On the 21st of January we had strong breezes at South East. In the day we carried all sail, the ship occasionally coming up to the windward of her course two points, but going seven knots throughout the twenty-four hours.

On the 22d of January we had strong breezes at E. S. E. We found the ship occasionally coming up to the wind, when all sail was set. It being on the quarter, I attribute it, in a great measure, to the trim of the ship being materially altered, by using too much water from the after-hold, and the whole of the provisions being used from aft. We also found the machine to require more weight

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when going with great velocity through the water; for in going seven or eight knots it nearly trailed on the top of the water, instead of being in the water three or four feet, when going four, five, or six knots. At 8 A. M. got the rudder in, and added more lead to the lower and fore part of the case, and sent a gang of hands into the fore hold to pump water off the casks aft. At 11 P. M. the machine was once more got over the stern, and found to steer much better, bearing a great deal of after-sail. Lat. 25° 56', long. 34° 17'.

On the 23d of January we had strong winds at E. S. E. going seven knots. Took in the mizen top-sail to assist the steerage. During the night very squally and strong breezes: the ship occasionally coming up from W. S. W. to S. W. At day-light a heavy sea running, the machine acting with great effect, under easy sail, going upon an average seven knots. The carpenter was employed in making a spare machine out of the derrick, with some further alterations. At noon strong trades, with a great deal of sea running. Lat. 24° 32', long. 36° 5'.

On the 24th of January we had strong breezes at East, with a great swell from the South East. At 8 A. M. observed the inner end of the machine had forced its way between two and three feet further through the socket of the frame in which it acted, and found the ship steered much better in consequence. Secured the cleats in their then position, and made all sail possible fore and aft, the ship requiring two hands at the wheel, but steering remarkably well; in consequence of which we declined proceeding with the other rudder, as intended; going upon an average seven knots.

On the 25th of January we had strong breezes at East. Royal and studding-sails, main-sail, spanker, and all sail set; the reefts out of all the top-sails, and the ship steer-

ing very well, and required to be pumped only twice in twenty-four hours. Lat. 22° 18', long. 40°.

We now considered the machine to be as complete and firmly fixed as it possibly could be, carrying all sail day and night. From this time until we made the island of Barbadoes nothing material occurred, which was on Sunday, the 10th of February, at half-past 11 P. M. bearing West four or five leagues distance. Moderate breezes at E. N. E. Took the studding sails in, and hauled to the Northward, under easy sail. At 4 A. M. wore ship to the Southward. At day-light the South East end of the island bore South West. At noon, sailing along the island, distance five miles. At 2 P. M. took in studding-sails, and hauled up for the shipping in Carlisle Bay, and anchored in eight fathoms water. Found lying there his Majesty's ship Dragon, of 74 guns, Rear Admiral Sir F. Le Forey, with three frigates, seven brigs, and four schooners, and about ten sail of merchantmen.

On the 11th of February, at 8 P. M. waited on the Admiral to acquaint him of our situation. Several gentlemen of the navy, and from shore, came on board to inspect the machine.

On the 12th of February we disembarked all the troops, government stores, and water casks. A survey was held on the ship by three gentlemen from the dock-yard, viz. Mr. Ward, the master builder, Mr. Lockwood, the master attendant, and Mr. Cruso, the Admiral's carpenter, and two masters of merchantmen; who unanimously recommended the ship to proceed on her voyage to Jamaica, with the temporary rudder, without any alteration whatever: which survey has been attested, on oath, at the Notary's office.

On the 13th and 14th of February many persons came on board to inspect the machine. Mr. Lockwood, the

master

master attendant, came on board to take the plan of the stern frame, and rudder, which he much approved of, from the simplicity of its construction.

On the 15th of February, at 7 A. M. weighed anchor, and made sail, attended by Mr. Lockwood, for the purpose of witnessing the effect of the machine. Made all sail upon a wind, and steering as well as with the regular rudder; standing off and on in sight of His Majesty's ships, lying in Carlisle Bay, and tacking with great facility until 6 P. M., when we bore away, and made all sail possible. From this time, until we made the East end of Jamaica, at noon on the 22d, the machine acted with equal effect on the ship as with the proper rudder, and carrying the same sail, having frequently very strong breezes, and a heavy swell; the ship for many hours together going nine and ten knots; making the passage, from Barbadoes to Jamaica, in a little less than seven days.

On the 23d February we anchored in Port Royal Harbour, and found lying there H. M. S. Polyphemus, Vice Admiral Rowley.

Thus ended a voyage in the ship Cornwall, having only sailed four days from England when she lost her rudder; and afterwards run a distance of at least 1250 leagues, being at sea 41 days, with a machine invented and improved upon progressively, on her voyage, for 18 days, when it was considered complete, and supplied the place of a regular rudder, far beyond our expectations, considering the rude idea which first presented itself.

Reference to the Engraving.

Plate V. Fig. 3, shews all the parts of this contrivance detached, and ready for launching over the ship's stern; Fig. 1 shews an elevation of it in action; and Fig. 2, a plan

plan answering thereto. The invention consists of a top-mast placed out of the ship's stern, having planks fixed at the end of it, which go edgeways through the water; the mast is attached to the stern by a kind of joint or socket, on which, by proper guys, it can be inclined in an angle, with the keel either larboard or starboard; and will steer the ship as effectually as a proper rudder.

To fit out a ship on this plan, the following materials must be collected and prepared as soon as the rudder is gone, or expected to be lost.

1st. A spare top-mast A B, Fig. 2, and two top blocks *h h*, which must be securely lashed on at each end of it.

2d. A top-sail-yard C D, which must have cleats, nailed securely upon it, forming a shoulder at the end C, which is to be kept on board: and at the opposite end must be framed a case *e e e*, formed of pieces of oak plank, nailed firm to the yard, on each side, the left or foremast part being chamfered off and leaded: so that by presenting a narrow edge it may make the less resistance in passing through the water.

As the taff-rail will not, in general, be found sufficiently strong to resist the force of the machine, a frame *k l m n*, must be composed of substantial pieces of oak, and erected behind it, upon the deck; it consists of two uprights *m m*, set up from a sill *n*, which is spiked down upon the deck; and they support a rail *p*, which is firmly lashed to the taff-rail: and the whole is strengthened by three shores *k k*, stepped from the deck to the uprights *m m*; between these is supported a piece of oak *l*, 4½ inches thick, with a hole through it, of a proper size to receive the end *f*, of the yard; the hole is leathered inside, in which the end *f* of the yard acts with perfect ease, and can swivel about in all directions; the tapered end *f* of the yard is leathered also, that the whole may act easily.

While

While these parts are preparing by one part of the crew, some should get the top-mast A athwart-ship, over her quarter, and make it fast by proper lashings; the others should be ready with the several tackles which rig it out, to give motion to the rudder when in the water. They are as follows: Two principal guys, *a a*, made of rope, which is 5½ inches girt, and should be of very good materials; they are to be made fast to the boards at *e e*, and carried through the top blocks at *h h*; the end has the block *r*, of a liff-tackle purchase, turned in; the other block being lashed to one of the stanchions on the ship's quarter, and the fall carried through the leading blocks *s s* to the steering wheel F, situated upon the ship's deck.

A topping-lift, *b b*, suspends the weight of the rudder from the spanker-boom G: it is a gun-tackle purchase, and is of great use in getting the machine out of the water, and also to assist in getting it in: the fall of the purchase is carried along the boom to a cleat spiked to it.

c is another topping-lift from the rudder to the mizen-mast head; it likewise assists to get in the machine, as well as for a substitute, should either of the guys break; it should be 3½ inch rope.

Two short luff-tackles *d d*, fixed to the taff-rail and cross piece *p*: they are for the purpose of holding the end of the mast firm in the socket, and materially aid in placing and displacing it.

A jack-stay, *i*. This is a rope stretched tight from the planks at *e e*, to the other end of the mast; on this a weight, *t*, is suspended. The machine is ballasted sufficiently for common occasions when the ship is going less than 8 knots; but this additional weight, consisting of shot sewed up in canvas, is to assist in keeping the whole of the machine in the water, when going more than 8 knots; and when going less, to be hauled up by the line *v*.

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The mode of operation in this machine will appear evident from the above description; the steering wheel F, being turned either way, acts to bring in the fall of one of the guys *a*, and give out the other, producing an inclination of the rudder, as in Fig. 2, so as to put the ship about as expeditiously as a common rudder; and upon the same principle, *viz.* that of making a resistance to the ship's motion, on either side of her keel, at pleasure. The ship Cornwall, in which the contrivance was first tried, had her wheel fitted close to the rudder-head, and she steered with a short tiller abaft the rudder. In ships fitted in the common manner, the tackles would lead to their wheels in a similar way; the only alteration from the figure being, that the wheel is placed much farther forward on the deck, and the leading blocks *s s*, are of course placed opposite to it.

Certificate and further Observations from Mr. A. LOCKWOOD, *Master-Attendant of H. M. Naval Arsenal, Barbadoes.*

The Cornwall lost her rudder on the morning of the 4th of January, and got this machine over on the 7th at noon; arrived at Barbadoes on the 11th of February, and at Port Royal on the 23d. During the passage from Barbadoes to Jamaica, this machine acted with great effect, the ship carrying royals and all studding-sails night and day, and for several hours together going 10 and 10½ knots; during which time she required less wheel than with the common rudder, and at no time did the temporary rudder require to make an angle of more than 10 degrees, either in the act of wearing or tacking.

This simple, and truly ingenious method of governing a vessel in distress, I recommend earnestly to the notice of all persons subject to casualties, that may require an expedient

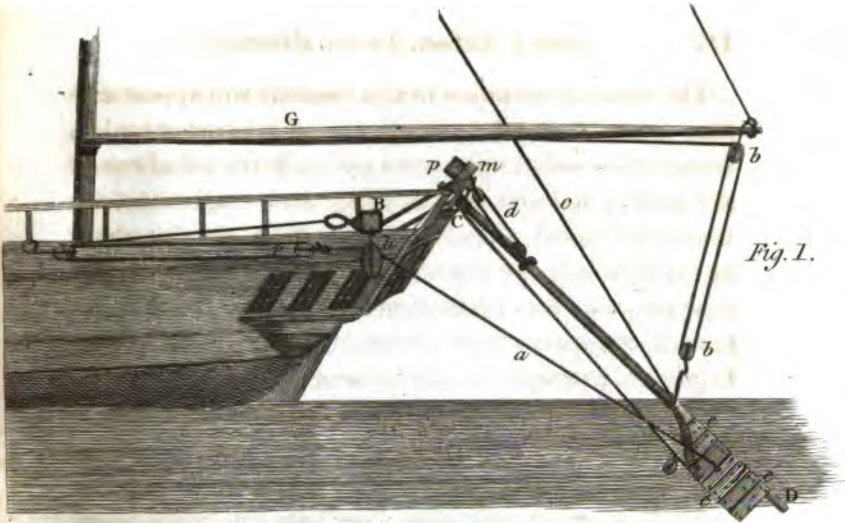


Fig. 1.

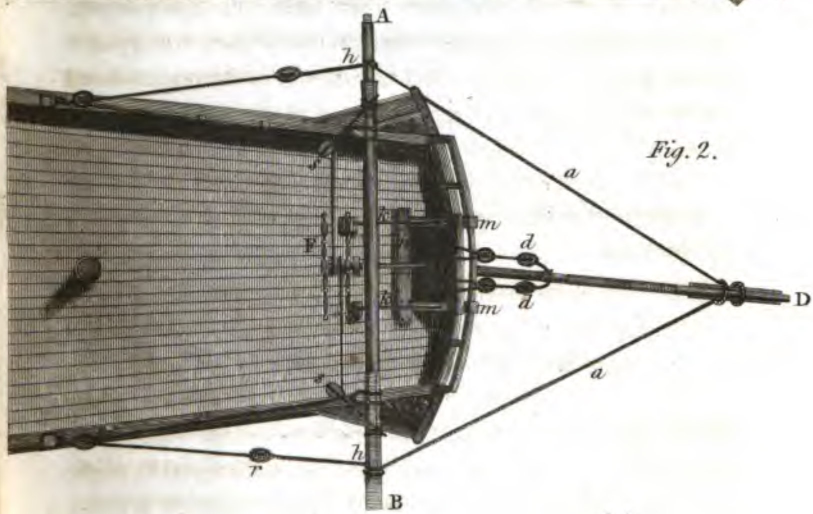


Fig. 2.

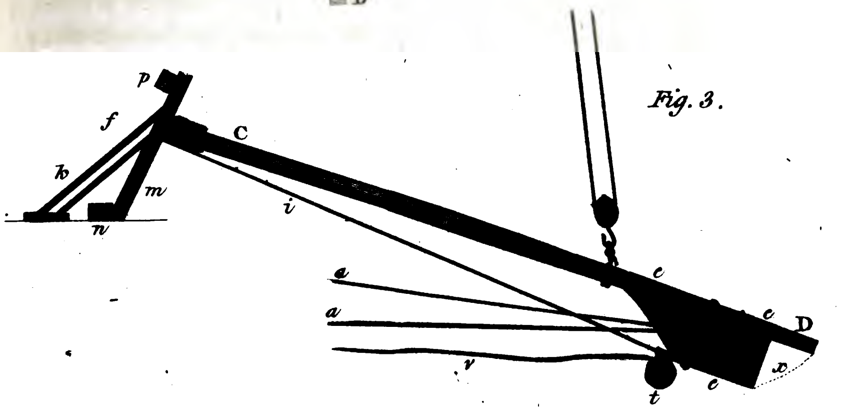


Fig. 3.

expedient of this kind; and although temporary rudders are no new subject, yet the one here delineated is unquestionably the best ever held to public view. Little more need be said in its praise, than the concurrent opinions of seven professional men (whom I know to possess clear judgment) that the rudder was superior to any that could be made at this island, and they had no hesitation in recommending Captain John Peat to proceed on his voyage to Jamaica, without any alteration in it whatever; and I can venture to assert, without hesitation, that the machine in question not only supersedes Pakenham's rudder, which stands in such high repute, but every attempt of that nature hitherto made, and reflects the highest credit on Captain Peat for his progressive improvement upon the rude idea which first presented itself.

The circumstances favourable to the machine are, first, its being composed of such materials as vessels of any description are possessed of; secondly, the simplicity of its composition superseding the absolute necessity of a carpenter; thirdly, that it may be constructed and put in action, even in a gale of wind, in two, or at most three hours. Its properties are, 1st. that it can be shipped at pleasure without delay, and with very little trouble; 2d. that it cannot, by any shock or violence, be rendered unfit or useless; 3d. that the guy-tackle fall, being brought to the wheel, requires only the same force to steer as the common rudder; that the ship is under complete command, as will appear by the ship's log-book, in all the following cases:

"Gale of wind, heavy sea, wind quarterly."

"Light winds, heavy swell."

"Fresh wind, spanker, main-sail and all sail, on a wind, off the wind."

"Staying and wearing."

 The

The sole object of this, my humble labour, being to promote, in however small a degree, the good of the nautical world; I cannot in justice drop the subject without suggesting what, in my opinion, would be, with little additional trouble, a very great improvement. The body of dead water occasioned by the flat open part *x*, of the planks at the end of the yard, tends to impede the ship's progress, and to force the case upwards, which consequently strains the guys when going very quick. The dotted lines at *x*, Fig. 3, I propose to be a piece of plank to be continued on the end of the topsail-yard, so formed or filled up as to carry off the body of water complained of. (Signed) ANTHONY LOCKWOOD.

On the proper Construction of Hot-bed Frames.

By THOMAS ANDREW KNIGHT, *Esq. F. R. S. &c.*

With an Engraving.

From the TRANSACTIONS of the HORTICULTURAL SOCIETY of LONDON.

THE most ignorant gardener would feel himself offended, were his skill in making a Hotbed, or giving proper directions for the form of a forcing frame, called in question; and this, perhaps, is the principal reason why the structure, and frames of all Hotbeds are so perfectly alike. The surface of the bed is made perfectly horizontal, and to give some degree of elevation to the glass, that end of the frame, which is to stand towards the north, is made nearly as deep again as the other; so that if the mould were placed of the same depth, (as it ought to be) over the whole bed, the plant would be too far from the glass at one end of the frame, and would want space at the other. To remove this inconvenience, I tried, several years ago, the effect of placing the Hot-

bed

bed on an inclined plane of earth, elevated about 15 degrees, making the surface of the dung and mould parallel with it, and adapting the form of the frame to the surface of the bed, as represented in the annexed sketch; Fig. 8 (Plate IV.), by which means the plants and the mould of the bed became more exposed to the influence of the sun. And as I have not discovered any disadvantages in the plan I have adopted, I have thought a description of it worth sending to the Horticultural Society; for though the improvement be trivial, it is not attended with any expense whatever, since the frame, when made as recommended, costs considerably less than when it is made in the form at present used: and as labour and expense to a very great amount are annually employed in making and managing Hotbeds, any improvement in their construction becomes of some importance to the market gardener.

I have often used, with great success, a frame and Hotbed thus formed for forcing grapes, by placing the bed at three feet distance from the wall, to which the vines were trained, and introducing their branches into the frame, through holes made at the north end of it (the vines having been trained to a south wall) as soon as the first violent heat of the bed had subsided. The white Chasselas grape, thus treated, ripens in July, if the branches of the vine be introduced in the end of April; and a most abundant crop may be thus obtained; but the necessity of pruning very closely renders the branches, which have been forced, unproductive of fruit in the succeeding season; and others, from the wall, must consequently be substituted. I have always put a small quantity of mould in the frame, and covered it with tiles.

If an inclined plane of earth be substituted for the Hotbed, and vines be trained in a frame adapted to it,

 the

the grapes (the Chasselas) ripen perfectly in August, and if small holes be made through the sides of the frame through which the young shoots of the vines can extend themselves in the open air, a single plant and a frame of moderate size, will be found to yield annually a very considerable weight of grapes. For this purpose the frames should not be more than eight or ten feet long, nor more than five or six in breadth, or the young shoots will not be so advantageously conducted out of them into the open air; and the depth of the frame, either for the hot-bed or inclined plane of earth, should not be less than eighteen inches. The holes in the side of the frame, through which the young shoots are to pass, should of course be closed during the spring, and till wanted; and if the weather be cold, it will be necessary to cover the frames at night. When the grapes are nearly full-grown and begin to ripen, it will also be highly advantageous to draw off the glasses during the day in fine weather, by which means the fruit will be exposed to the full influence of the sun, without the intervention of the glass, and will attain a degree of perfection that it rarely acquires in the vinery, or hothouse.

Description of a Forcing House for Grapes; with Observations on the best Method of constructing them for other Fruits. By T. A. Knight, *Esq. F. R. S. &c.*

With an Engraving.

From the Transactions of the Horticultural Society of London.

So much difference of opinion prevails amongst gardeners respecting the proper forms of Forcing Houses, that two are rarely constructed quite alike, though intended

tended for the same purposes: and every gardener is prepared to contend that the form he prefers is the best, and to appeal to the test of successful experiment, in support of his opinion. And this he is generally enabled in some degree to do, because plants, when properly supplied with food and water and heat, will succeed in houses, the forms of which are very defective; and proper attention is not often paid by the gardener, when his prejudices satisfy him that his labours cannot be successful. It is, however, sufficiently evident, that, when the same fruit is to be ripened in the same climate and season of the year, one peculiar form must be superior to every other, and that in our climate, where sunshine and natural heat do not abound, that form, which admits the greatest quantity of light through the least breadth of glass, and which affords the greatest regular heat with the least expenditure of fuel, must generally be the best: and if the truth of this position be admitted, it will be very easy to prove that few of our Forcing Houses are at present ever moderately well constructed. I therefore think that if plans and descriptions of such Forcing Houses, as theory and practice combine to prove to have been properly constructed for the culture of every different species of fruit, were published by the Horticultural Society, much useful information might be conveyed to the practical gardener: and under these impressions I send the following description of a Vinery, in which the most abundant crops of Grapes have been perfectly ripened within less time, and with less expenditure of fuel, than I have witnessed in any other instance.

It is well known that the sun operates most powerfully in the Forcing House, when its rays fall most perpendicularly on the roof; because the quantity of light, that glances off without entering the house, is inversely proportionate

portionate to the degree of obliquity with which it strikes upon the surface of the glass; and it is therefore important to every builder of a Forcing House to know by what elevation of the roof, the greatest quantity of light can be made to pass through it. To ascertain this point, I have made many experiments, and the result of them has satisfied me that, in latitude 52, the best elevation is about that of 34 degrees: and relative to that elevation the position of the sun, in different parts of the year, will be nearly as represented in the annexed sketch; which is taken from the Vinery I have mentioned. About the middle of May, the elevation of the sun will nearly correspond with that of the asterisk A (Fig. 6. Plate IV.), and in the beginning of June, and again early in July, it will be vertical at B, and at Midsummer it will at C be only 6 degrees from being vertical. The asterisk D points out its position at the equinoxes, and E its position in midwinter.

In this building, which is forty feet long, and is heated by a single fire-place, the flue goes entirely round without touching the walls; and in the front a space of two feet is left between the flue and the wall, in the middle of which space the vines, which are trained to the roofs, about eleven inches from the glass, are planted; and as both the wall and flue are placed on arches, the Vines are enabled to extend their roots in every direction, whilst, in the spring, their growth is greatly excited by the heat, which their roots and stems receive from the flue. Air is generally admitted at the ends only, where all the sashes are made to slide, to afford a free passage of air through the house, when necessary, to prevent the Grapes becoming mouldy in damp seasons. About four feet of the upper end of every 3d light of the roof, is made to lift up, (being attached by hinges to the

wood-

wood-work on the top of the back-wall) to give air in the event of very hot and calm weather; for I prefer giving air by lifting up the lights, to letting them slide down, because when the former method is adopted, no additional shade is thrown on the plants.

The preceding plan is here particularly recommended for a Vinery only; but I am confident that by sinking the front wall below the level of the ground, and making a small change in the form of the bark-bed, the same elevation of roof may be made equally applicable to the pine stove, and that no upright front glass ought, in any case whatever, to be used; for light can always be more beneficially admitted by adding to the length of the roof, if that be properly elevated; and much expense may be saved both in the building, and in fuel. For forcing the Peach or Nectarine, I must, however, observe that I think any house of the preceding dimensions wholly improper; and I purpose to submit a plan for the improved culture of those fruits to the Horticultural Society at a future opportunity.

The Vine often bleeds excessively when pruned in an improper season, or when accidentally wounded, and I believe no mode of stopping the flow of the sap is at present known to gardeners. I therefore mention the following, which I discovered many years ago, and have always practised with success: if to four parts of scraped Cheese be added one part of calcined Oyster-shells, or other pure calcareous earth, and this composition be pressed strongly into the pores of the wood, the sap will instantly cease to flow; the largest branch may of course be taken off at any season with safety.

Application of the Heat (that escapes through Chimneys of the Boilers in large Establishments,) to a Ventilator and a Stove, which may be adapted to the Fabrication of Syrups, Sugar, Soap, and Indigo; to the Manufacture of sulphuric Acid, raw Soda, and Salt of Soda, of Alum, Potash, and Salt-petre, and all others where Liquids are evaporated, and the extracted Matter dried.

By M. C. Pajot des Charmes.

(Continued from Page 60.)

IN order to give a view of the advantages depending on this evaporator, submitted to the ventilation produced by the heat in the chimney, it is sufficient to say, 1st, that the result of the cold experiment, made over a vessel of eight feet by four, and containing eight inches of liquid, as in the preceding experiments, gave in twenty-four hours an evaporation of a nineteenth part of the mass; 2d. that the same quantity of liquid evaporated by the same means, in the same vessel, heated only at the bottom, was reduced one-twelfth part during the same period of twenty-four hours. The temperature of the liquid in the second instance was not raised beyond 60 degrees of Reaumur.

By adopting, therefore, in the front of a set of evaporators to be heated, a similar set of cold evaporators, it is easy to reckon before hand, at least by approximation, the advantages attached to this combination. Thus, by following the process of cold evaporation, a previous concentration of the liquid will be obtained, which, when poured into the warm evaporators, disposed in the same manner as the cold, will yield its product in a space of time necessarily very short, compared with the time required by the ordinary methods.

To

To this economy of time, which is the most precious, as it at the same time saves both fuel and labour, is added the advantages resulting from the application of the cover upon the boilers, and which consist in the cleanliness and salubrity of the establishment, circumstances which have the greatest influence on the quality of the product.

The aperture made in the chimney should not be done indifferently; that which has given place to the ventilator was stopped according to the knowledge of the degree of heat of the body of the chimney on the outside, its thickness being always taken into consideration. In the application now in question, the aperture in the chimney was made twelve feet below the fire-place of the reducer, which was the mean height between the fire-place and the upper extremity of the chimney above the roof. One of Reaumur's thermometers put in this place, and in contact with the wall of the chimney, which was eight inches thick, indicated 80 degrees.

The aspirating aperture on the side of the cold evaporators built against the opposite front of the body of the chimney was made three feet above the air-hole on the side of the warm evaporators. At these different elevations the play of these two species of aspirating pumps occasions no risk of accidental fire either to the building or the covers, which, by way of precaution, were coated with a light coat of plaister, in the length of from two to three feet from their base.

It will be observed, that the rarifying force of the heat that escapes naturally determines the velocity of the air that is drawn under the case and cover of the boilers. The product of the vaporisation follows in proportion.

Although the doors or flaps in the case that were made to open at the side of the boilers have been described as turning on hinges, they may nevertheless be made to slide;

 or,

or, perhaps, Venetian-blinds would be still more advantageous from the facility they would afford to the distribution of the current of air in the most convenient way for the evaporation of the liquid.

I have tried at different times the effect of opening the doors which touch the body of the chimney at the same time with those placed above the fire-places: I thought that the common action of the two currents of air introduced at once would produce a more considerable evaporation, but my expectations were deceived, for the air, in passing along the wall of the chimney, appears to injure the celerity of that which comes in the line of the fire-place.

It is not useless to note, that the ordinary temperature of the building, where the set of warm evaporators were disposed, was from 15 to 20 degrees of Reaumur, and that observed in the opposite part where the cold evaporators were placed was nearly 25 degrees. This latter temperature was produced by the heat transmitted through the body of the chimney, and more subject to a concentration in the second locality as it was much less spacious than the first.

I ought to observe, that when the salt is intended to be extracted in a crystalline form, the vessel into which it drops should be removed, in order that it may not be in the way of the evaporator belonging to the reducer.

§. III. *The agitating Balance-Beam.*

This instrument has been employed, constructed in two ways: the first model was composed of a wooden frame, in the shape of a hammer; at each end of its cross piece were fixed small wheels, or pullies; either a single one, with shoulder piece and sockets, or two together;

ther; one of which was vertical, and the other horizontal; and both of them free in their frames.

In the first case the wheel moved in its frame, which was contrived so as to prevent it from deviating. With respect to the two wheels placed in one frame, that which was vertical served to put the frame in motion, and that which was horizontal prevented its deviation.

The tail of the frame was directed in its course upon a small roller, placed between two uprights, which keeps the frame from slipping out of its place. The tail of this is furnished with four agitators; one of which plays in the preparing boiler, and the three others in the reducer or evaporator. The bars of these agitators may be either round or square; when of the latter form, their angles are presented to the liquid. Their length here is about six or seven inches; they never touch the bottom of the boilers, they are disposed so as only to impress a sea-saw motion to the right and left on the surface of the liquid, which is thus put in contact with the air that is attracted by the heat, and which, acting as a ventilator, escapes continually through the chimney of the fire-place belonging to the boilers.

The bars of the agitator, instead of filling the whole length of the cross piece fixed to the tail of the frame of the balance beam, only fills one part, that is, one agitator is furnished with bars at the two extremities; the next only has them in the middle; and so on with the other agitators alternately.

A small roller, placed above the tail of the frame, and nearly in the middle of its length, is furnished with an appendix, armed with a sector, the notches of which play into a small hook, adapted to the tail, or it is simply furnished at its extremity with a sort of fork, into which a tenon, fixed on the tail of the frame, enters

freely. The axis of this roller, on one side, plays in the partition already mentioned, which separates the two boilers; the other rests on the reducer; and to this extremity is adapted a balance-beam, which, by its alternate motion, causes the frame to move in the direction given to the appendix, which in its turn moves to the right and left either the hook or fork above described, and which thus contributes to agitate the liquid, and to change its surface, according to the degree of velocity given to this balance-beam.

The second mode of constructing the agitating balance consists only of a wooden cross piece, fixed in the middle of the length of the evaporator or reducer, as much upon its edge above the line of the fire-place as upon that which separates it from the preparer. Along this cross piece are fixed, in suitable places, four agitators, disposed the same way as those of the first model, with the exception, that in this they move round a pin, which collects them to the cross piece, while those of the first are fixed, being not susceptible of any motion upon themselves. The agitators are fastened the one to the other, so that the one which receives the motion immediately communicates it to those which precede or follow it.

These two agitating balances both fulfil their object very well, and they are easily removed when required.

§. IV. *The Evaporator*

Is a frame of light wood, four inches shorter and less in diameter than the boiler into which it is to be immersed. Upon its circumference are fixed four hurdles of white osier, the twigs of which are from three to four lines in diameter, and some inches longer than the depth of the evaporating vessels. These twigs are also about

an

an inch and a half distant from each other, and are maintained at that distance both above and below by several bands of osier. The upper part has a firm and fine network of osier, the length of an inch and a half downwards, and the lower part is interlaced in the same manner to at least six inches upwards; the intermediate part remains open. The four hurdles thus connected round the frame and fastened to it, form altogether but one piece with it. On the long sides of this frame are made a number of notches an inch and a half asunder, to receive the ends of small hurdles of osier, of which the slips being the same size as the others before mentioned, are kept asunder and confined above and below in the same manner. The small hurdles inside the frame, are maintained at equal distances by one or two slips of osier or an iron wire covered with cloth, according to the nature of the liquids to be evaporated; by this means they form one body with the small hurdles that are fixed at each extremity of the length of the frame; the ends are besides kept in the notches on one side by a cross piece placed on them, and on the other by little turn buttons placed upon each notch; this gives facility to the removal of each hurdle separately when they require to be repaired or changed. The placing of the hurdles round the outside of the frames is performed with the same precautions, and in such a manner that the open part be neither higher or lower than that of the small hurdles.

Upon each angle of the frame, or at a distance from its short sides or ends, is placed a ring, to which a cord is attached. Those which rise from the two rings fixed upon the two long sides, are collected and knotted so as to form towards the knot, the summit of a triangle, more or less obtuse according to the open space that is left above the evaporating vessels. From this knot proceeds

a cord

a cord which passes over pullies conveniently placed, and by means of which, and two similar cords to which the frame is attached, this frame is raised and lowered, together with the hurdles affixed to it. In this case, one person is employed upon every cord, as they are almost always too far apart to admit of their being managed by the same individual. But if there be room sufficient in the premises, the cords may all be wound round a roller, which must be fixed at a convenient height, either at the head of the fire place, or in a line with the evaporator and reducer, or in the line of separation between these two boilers and the preparer. By this disposition, it is evident that a single workman is sufficient to manage the whole.

When the apparatus is thus prepared, it is employed in the following manner: In the first place, let us suppose the frame to be raised to about the height of four feet and a half above the vessel containing the liquid to be evaporated. If the situation will allow of a greater elevation of the frame, without fear of the splashes of the liquid out of the vessel, it is to be preferred. Let us also suppose eight inches of liquid to be in the vessel, which vessel is here understood to be square sided and flat at the bottom. The frame with its osier furniture is lowered, until the osier touches the bottom of the vessel. In the next moment the frame is raised again, to the height from which it was lowered, and the liquid imbibed by the osiers is suffered to drop from it. When the dropping ceases the frame is again immersed and then raised as before, and this operation is successively repeated, whether the evaporation be warm or cold. The only difference requisite in regard to the immersions is, that when the liquid is heated, to wait not only until the drops of water cease to fall from the frame, but also

until

until the smoke and aqueous vapour is no longer apparent.

Let us now suppose, that the immersion has been renewed as above described, during a given time; at the expiration of which it will be perceived, first, that the height of the liquid in the vessel has diminished very sensibly; second, that the remainder of the water, if it is brackish, has acquired several degrees of concentration. We cannot compute exactly the quantity of liquid that will have evaporated, nor the number of degrees of concentration it will have acquired. These two products, when the evaporation is cold, depending on the size of the vessels, on the degree of heat of the liquor when the ventilator begins to act, on the state of the surrounding air, and also on the attention of the workman; and when the evaporation is warm, they not only depend on the circumstances here mentioned, but also on the management of the fire.

TO BE CONCLUDED IN OUR NEXT.

List of Patents for Inventions, &c.

(Continued from Page 64.)

WILLIAM MOULT, of Bedford-square, in the county of Middlesex; for an improved method of acting upon machinery. Dated May 21, 1814.

WILLIAM NEVILLE, of Birmingham, in the county of Warwick, Merchant, and Coach Brass-founder; for a method of making hurdles, gates, palisades, virandas, balustrades, stair-case rails, espalier frames, and various other articles. Dated May 26, 1814.

JOHN

John Buxton, of Great Pearle-street, Spital-fields, in the county of Middlesex, Cotton-manufacturer; for an improved method of twisting and laying cotton, silk, and various other articles. Dated June 5, 1814.

William Sellars, of Kemsey Elms, in the county of Worcester, Engineer; for a method of spinning and laying of ropes, twine, line, thread, mohair, wool, cotton, and silk by machinery. Dated June 5, 1814.

Grant Preston, of Burr-street, London-dock, in the county of Middlesex, Brazier; for a concavious cabbin-stove. Dated June 5, 1814.

John Stubbs Jorden, of Birmingham, in the county of Warwick, Copper Sash Manufacturer; for an improved method of making the lights, and also other improvements in the construction of Horticultural buildings. Dated June 7, 1814.

George Heyward, of Brocknor Iron-works, near Stourbridge, in the parish of King Swinford, in the county of Stafford, Ironmonger; for an improved plan or method of turning rolls, and of rolling gun and pistol barrels previous to welding. Dated June 7, 1814.

Thomas Tindall, in the county of York, Gentleman; for certain improvements on the steam-engine, and also a mode of applying the same to the driving of all sorts of carriages and machinery. Dated June 18, 1814.

THE

REPERTORY

OF

ARTS, MANUFACTURES,

AND

AGRICULTURE.

No. CXLVII. SECOND SERIES. Aug. 1814.

Specification of the Patent granted to John Buddle, *of Wallsend, in the County of Northumberland, Gentleman; for a Fire-pan or Fire-lamp, in which small or inferior Coals may be consumed in the Place of large or round Coals; and also of a Fire-grate or Fire-stove, to be fixed at the bottom of the Chimney in the ordinary Mode, in which Fire-grate or Fire-stove small or inferior Coals may be consumed on all Occasions, and for all the same Purposes as large or round Coals.*

Dated February 21, 1814.

With a Plate.

To all to whom these presents shall come, &c. Now know ye, that in compliance with the said proviso, I the said John Buddle do hereby describe and ascertain the nature of my said invention of the said fire-pan or fire-lamp, and in what manner the same is to be performed, as follows, reference being had to the drawings in the annexed schedule; that is to say: First, the fire-pan or fire lamp may be made of a circular or pentagonal, or rectangular, or any other convenient shape. The body of it may be formed horizontally or vertically, with a pyramidical, convex, conical, horizontal, or con-

cave bottom, or a bottom of any other shape that may be found convenient, and such bottom may be made of iron, brass, or any other materials. The bottom of the fire-pan or fire-lamp should either be formed into one or more vertical tubes, or one or more vertical tubes should be fixed into the bottom of the fire-pan or fire-lamp, for the purpose of admitting the air. These tubes may be made of iron or any other metal, and may be formed of vertical or horizontal bars, or in any other shape that may be sufficiently capable of admitting the air freely into the fire. Dampers or valves may be fixed at the bottom of the tubes, for the purpose of qualifying and regulating the admission of the air as circumstances may require, and a funnel or funnels should be placed on that side of the fire-pan or fire-lamp from which the wind may happen to blow, to be used and applied as occasion may require. In the annexed schedule I have delineated six drawings of the fire-pan or fire-lamp: Fig. 1, (Plate VI.) represents a rectangular fire-pan or fire-lamp with a pyramidical bottom; A shews the tube or chimney through the bottom, B the damper or valve to regulate the admission of the air, C the handle; the sides D E F G, may be formed of parallel bars or of perforated plates. Fig. 2, represents the plan of the same rectangular fire-pan or fire-lamp with its tube and sides. Fig. 3, represents a circular fire-pan or fire-lamp with a conical bottom. Fig. 4, represents the plan of the same circular fire-pan or fire-lamp. Fig. 5, represents the section of a vertical fire-pan or fire-lamp, which may be made of a circular or pentagonal, or rectangular, or any other shape that may be found convenient. A shews its tube or chimney, B B the body, C C its legs, D the damper or valve, E its handle. Fig. 6, represents a rectangular fire-pan or fire-lamp with an horizontal bottom; A shews the

Fig. 1.

Fig. 2

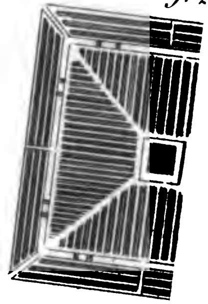
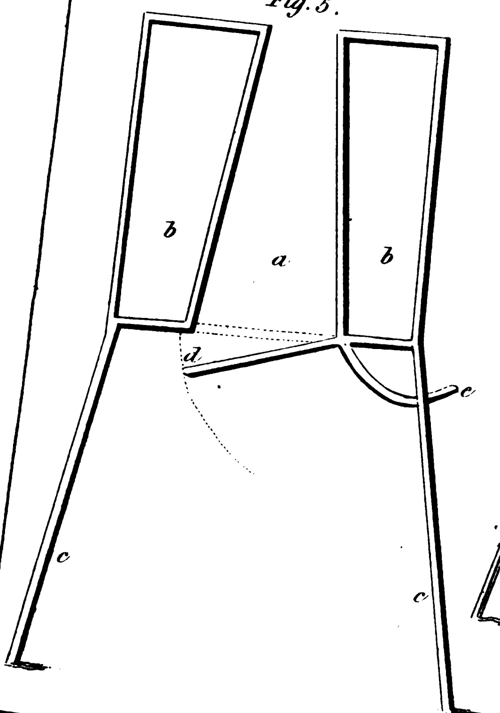
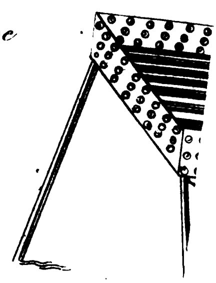


Fig. 5.





the funnel with the several branches, numbers 1 2 3 4, for the purpose of admitting the air into the fire through the bottom. I also describe and ascertain the nature of my said invention of the fire-grate or fire-stove, and in what manner the same is to be performed, as follows, reference being also had to the drawing in the annexed schedule; that is to say: The fire-grate or fire-stove must be made with a pervious back, and must be placed in such a manner as that a space may be left between such pervious back and the back wall of the fire-place. Such space is intended to form an aperture for the admission of air into the back part of the fire through the pervious back, and a damper or valve is to be fixed at the bottom or top of such aperture, to regulate the admission of the air as circumstances may require. In the annexed schedule I have also delineated a drawing of a fire-grate or fire-stove; namely, Fig. 7, represents the section of a fire-grate or fire-stove, A shews the fire-place, B B the space between the pervious back and the back wall of the fire-place, C C the dampers or valves, D D the pervious back, G G the bars in the ordinary way, H the ash-pit, K the chimney.

In witness whereof, &c.

Specification of the Patent granted to EMANUEL HEATON, *of Birmingham, Gun Finisher; for Improvements to the Locks and Breeches of Fire-arms, by rendering the Pans of Locks, and Communication between the Priming and Loading of Fire-arms, water-proof.*

Dated March 23, 1814.

TO all to whom these presents shall come, &c. Now KNOW YE, that in compliance with the said proviso, I the said Emanuel Heaton do hereby declare that

 the

the nature of my said invention, and in what manner the same is to be performed, are particularly described and ascertained as follows; that is to say: The pan of the lock may be in the common or any other form, allowing sufficient capacity that the operator may chuse; but instead of being open-mouthed at the end next the barrel of the pan, its edge or lip must be elevated all round, and a rim or small interval lower than the edge must be left at the end of the pan next the touch-hole, between the edge of the pan and the barrel of the piece; the touch-hole may project about the sixteenth part of an inch towards the lock, and be let into an orifice made through the rim and edge of the pan to receive it. Around this orifice in the rim of the pan, and also round the touch-hole, a small groove must be formed, into which must be inserted a shred of leather or other elastic substance impermeable to water, that when the lock is screwed to the barrel of the piece, the projecting edges of the leather or other substance in the grooves may be pressed close and firmly by the barrel and nill of the lock reciprocally; the seat of the hammer must be of the same form as the pan, and project beyond its elevated edge all round, and must be hollowed out or made concave to the extent of the exterior of the edge of the pan. Into the cavity of the seat of the hammer, must be inserted a piece of leather or other substance, which, when pressed on it by the hammer-spring, will closely adhere to the edge of the pan; but leather I use; and this must be secured in its position by a plate of iron or other metal, of the form and size of the interior of the pan, fastened on the leather or other substance by a small screw passed through the seat of the hammer, and received by the plate; when the whole is thus prepared, the pressure of the hammer-spring on the edge of the pan

pan will force the latter into the leather or other substance, and prevent the admission of air or water into the pan, and the projecting edges of the leather or other substance in the grooves of the rim, and round the touch-hole, will also exclude air and water from it, and the communication between the priming and loading of the piece will be water-proof: the touch-hole may project in the manner above stated, but it is not necessary that it should. In witness whereof, &c.

This Patent is assigned to Mr. Theophilus Richards, Gun-maker, of Birmingham, who states that an experienced sportsman, to gratify the curiosity of a few friends as well as to furnish himself with complete evidence of its effect, undertook in the face of the public to discharge a fowling-piece twenty-four times at some swallows on the banks of the canal, near Birmingham; between each discharge, after re-loading, he immersed the stock and lock of the piece in the canal. The time occupied was little more than an hour, and when it is considered that the piece never once missed fire, and, that he killed nineteen birds out of the twenty-four shots; it must be admitted, not only that the discharge was to the full as quick as can ever take place, but that all doubts of the invention answering every intended purpose must be entirely removed.

Air and water being excluded from the prime of these guns, causes them to explode much quicker than any others.

N.B. The Figs. 1, 2, 3, (Plate VII.) and references, are communicated by the present Proprietor of the Patent, but do not form part of the Specification.

Fig. 1, A the breech, B the touch-hole, with the rim of leather.

Fig.

Fig. 2, C the orifice, communicating with the pan, having an elevated rim or bridge.

Fig. 3, D the pan open, corresponding with the reference C. E the hammer thrown open. F the plate securing the leather, which is represented by the dark rim surrounding the plate.

Specification of the Patent granted to EDWARD HEARD, *of the Parish of Saint Luke, in the County of Middlesex, Chemist, late Chemical Director of the London Plate Glass Works, East Smithfield; for certain new and improved Processes for the Manufacture of Plate-glass.*

Dated August 9, 1813.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said Edward Heard do hereby declare the nature of my said invention, and the manner in which the same is to be performed, are particularly described and ascertained as follows; that is to say: First, in the application or use of flints (previously reduced to a granular state by suitable mechanical means, and afterwards sifted through sieves of different-sized meshes, in order to separate the required numbers or sized grains) to be used as a substitute for, or in lieu of, sea, river, or other common sands heretofore employed for abrading or grinding of plate-glass, and which ground glass and sand has hitherto been thrown away as useless. Secondly, in the collecting or saving of the glass thus abraded, in the intermixed state with the ground flints, purifying the same from extraneous or injurious matters, and re-melting it for the re-production or composition of plate-glass, with an additional proportion of alkaline or other fluxes,

the

the precise quantity of which must be determined by experiment, the amount depending on the presumed quantity of flints left in the combined mass.

In witness whereof, &c.

Specification of the Patent granted to ROBERT ADAMS, *of Holborn, in the County of Middlesex, Shoemaker; for a new and improved Method of preparing Blacking, whereby a higher Polish is given, and the Leather better preserved than by any hitherto known.*

Dated July 7, 1813.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said Robert Adams do hereby declare that the nature of my said invention, and the manner in which the same is to be performed, is described and ascertained in the following explanation thereof; that is to say: In order to make forty gallons of blacking, take forty gallons of the vinegar commonly known by the number eighteen, ninety pounds of ivory-black, three gallons of sweet oil, wine measure, twenty-eight pounds of raw moist sugar, eighteen pounds of oil of vitriol, and twenty-six ounces of gum arabic, and procure a tub with a tin strainer fixed under its lid or cover, nearly of the same size as the lid and full of small holes; and with a hole in the lid sufficiently large to admit the pouring in of the liquid ingredients, for which purpose a funnel may be used if required: put the ivory-black, the sugar, the sweet oil, and four gallons of vinegar into the tub, and make them into a thin paste, then apply half the oil of vitriol through the lid and strainer, and after letting it stand between five and ten minutes, pour through the strainer about two gallons more of the vinegar, then take

off

off the lid, and gradually pour in the remainder of the vinegar, keeping the whole continually on the stir till all the vinegar is used; it being thus well stirred, put on the cover, and pour in the remainder of the oil of vitriol through the strainer, then pour it into a copper, put in the gum arabic and let the whole boil, and when it begins to boil it is fit to be drawn off, and when cold to be bottled, but while being bottled should be constantly stirred. To make a less quantity than forty gallons, a proportional part of the above ingredients to the quantity required should be used in the same manner.

In witness whereof, &c.

Account of an Invention for reducing the Expense of Carriage on Rail-ways and other similar Roads: being the Copy of a Letter transmitted to the Secretary of the Society of Arts, in London; dated Scarborough, June 4, 1814.

Communicated by the Authors in a Letter to the Editors.

With an Engraving.

Sir,

We the undersigned, beg leave to present your honourable Society with a brief specification of an invention of ours, for facilitating the means and reducing the expense of carriage on rail-ways, and other similar roads; and from which, we hope, much public advantage may be derived.

It will be best understood by a reference to the sketch*, Fig. 4, (Plate VII.), which represents a train of

* To avoid confusion, the wheels of the carriages are omitted; the lower segments of the rims only are shewn. The dotted circles represent pullies which, if requisite, may be used for locking the chain on those beneath them. The dotted lines represent the chain.

Tindall & C^os Railway.

Fig. 4.

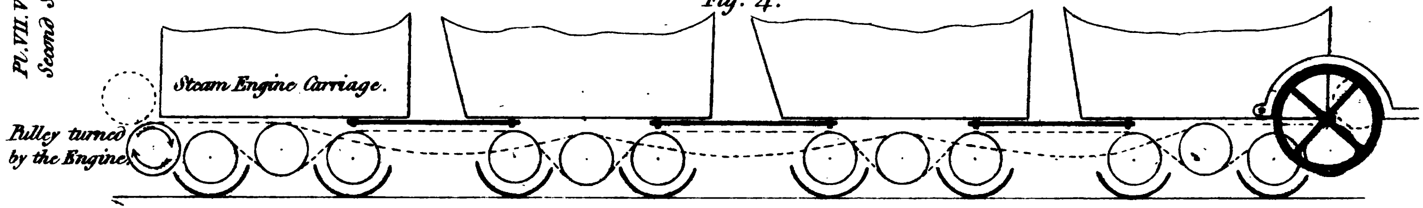
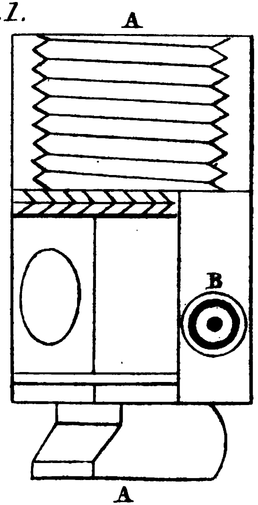


Fig. 1.



M^r Healon's Patent.

Fig. 2.

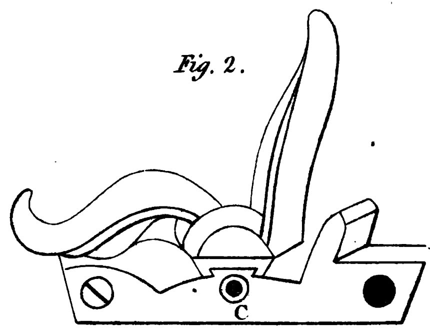
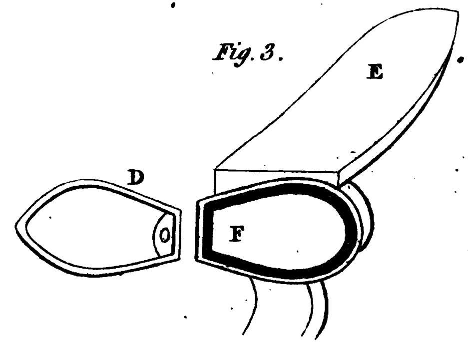


Fig. 3.



of carriages, such as are commonly used on rail-ways. On one of the carriages is placed a steam-engine, or other first mover, the power of which is applied to turn the wheels of the whole train, and by their impinging against the surface of the rail-way, to produce the movement of all the carriages.

Four only are described in the sketch, which we apprehend to be sufficient for the purposes of explanation; but it is obvious that the train may be composed of a much larger number; and that in a commercial view, a larger number would be preferable.

With respect to the apparatus exhibited, we conceive it to be as convenient, and of as extensive application, as any with which we are acquainted. The carriages are held together, and a rotary motion communicated to their wheels, by means of an endless chain, which passes over toothed and grooved pullies fixed on some convenient part of the axles of the wheels, and under and nearly round a toothed pulley turned by the power of the engine; while the carriages are kept at a suitable distance asunder, by bars of iron or other convenient material, the ends of which are forked or perforated for the reception of iron pins, which project from the carriages, and serve in conjunction with the bars, as the joints by which the train bends, and accommodates itself to the usual varieties of angle and curvature.

According to this arrangement, the wheels of the carriages are, of course, firmly fixed and united to their axles, so as to turn round therewith; and are likewise all of one diameter; as are also the pullies over which the chain passes, and over the centres of which the pins project.

The intermediate pullies are used chiefly for the purpose of pressing down the chain on a larger portion of

the circumference of the pullies on the axles of the wheels, and may without inconvenience, be of various sizes.

In some arrangements of the chain, the intermediate pullies would be altogether unnecessary.

The slack chain is hung over pullies, fastened to the arbors of the intermediate pullies; but loose pullies would suffice, and in some cases might be more convenient.

Respecting the chain, it may be proper to observe, that it is composed of circular and oval links, placed alternately, and may easily be repaired or lengthened, by means of shackles with screw-bolts, &c. We conceive it to be of new and advantageous construction; and calculated for general use in mechanism.—The pullies are toothed to suit the circular links; the indentations, by which the teeth are produced, being nearly semicircular.

In order to prevent the too rapid descent of the train, on declivities, the hindmost carriage is furnished with an apparatus, something similar to that used for regulating the velocity of a common roasting jack; a brake being added, the better to preserve the government of the whole.—The regulating apparatus, which in the sketch is connected with a pulley under and nearly round which the chain passes, may be variously arranged and constructed; and may be either in or out of gear, according to circumstances.

From this general outline of our invention, it will readily be perceived, that its chief design is to promote the more extensive employment of the steam-engine, by obviating, with reference to the mechanical movement of carriages, all necessity for any alteration of the common rail-ways, or for any of the expensive appendages which have been proposed.

The

The whole scheme obviously admits of abundant modification; but as in reducing it to practice, we must of necessity proceed in the most open manner, any further detail might seem superfluous.

Suffice it, therefore, in conclusion, to observe, that we do not confine ourselves to such carriages as are at present in use, or to the arrangement of apparatus which has been described, or to the use of the said apparatus, however modified; but that as circumstances may direct, and render expedient, we propose to construct other carriages, or frames of carriages, variously jointed, and without limitation as to number of wheels, and to avail ourselves of all the different means, well known to mechanics, of communicating motion from one distant wheel to another, or from one distant axle to another; and moreover, that we also contemplate other means which we believe to be not generally known, but with which, as we have not any certainty in this particular, we shall not encumber our specification; but shall bring them forward in such other manner, as may be judged most conducive to the public benefit.—In witness whereof we beg leave, Sir, respectfully to subscribe ourselves,

To the Secretary of the Society of Arts, &c. London.

Your most obedient servants,
WM. TINDALL,
JOHN BOTTOMLEY.

P. S. Perhaps it may be proper to add, that although the apparatus be easy to attach and detach, yet that on rail-ways which are nearly level throughout, we do not propose to extend it to all the wheels of a train, but only to such part of them as may be requisite.

What proportion this part may bear to the whole, experiment must determine; and we apprehend it will be found to vary according to the weather and seasons.

Possibly, in dry summer weather, the impinging of the wheels of the train of four carriages, which has been described, might on a perfect level, suffice for the movement, in addition, of six or eight other similar carriages, attached to it and to one another in the usual manner: but on this head we cannot attempt to speak with precision.

In submitting the invention specified in the foregoing letter to the candour of a liberal public, the inventors beg leave to express their readiness to correspond with any gentleman who may feel desirous of reducing it to practice.

They might perhaps have been able to secure to themselves by letters patent, their right to the exclusive enjoyment of the advantages that it promises: but this they have not done. Any person, therefore, is at liberty to avail himself of the benefits to be derived from it; and it is the wish of the inventors that it should meet universal adoption.

Letters, post paid, addressed to them at Scarborough, stating the colliery or rail-way, with reference to which application is made, together with such particulars respecting it, as it may be thought expedient to communicate, will be duly noticed.

Observations on Latent Heat in Steam.

By Mr. J. C. Hornblower.

Communicated in a Letter to the Editors.

Gentlemen,

I have been long disposed to controvert this notion of the new school, and had it not been for a superstitious regard to the authority from whom the doctrine originated

ated should long ago have protested against it; but the name of Dr. Black and his cotemporaries always operated as a caveat in coming to a conclusion on the subject.

Before I enter on the arguments adduced in support of the doctrine of latent heat in steam, it will be proper that I should express the notions or ideas which are conveyed to me by sundry terms appropriated thereto, for it may be, that I do not hold them in the same sense that others do, nor so apply them.

I think I agree with them in their adoption of the term *caloric*, to signify *that something* which is the basis of this subject; the word *heat* being more properly the sensation excited by the agency of that same thing, or in other words the effects of its agency; and I instance it in those cases where one's nerves are acted upon by it, or where its agency becomes visible, as in the expansion of mercury in the thermometer; this is what I suppose is understood by the terms *free caloric or uncombined caloric*.

By latent heat I understand such a combination of caloric with bodies in general, as to be considered a component part, or to abide inherently with such bodies, and that in such a state as to elude any efforts hitherto attempted to measure its quantity; but if it can be ascertained by any method, however circuitous it may be, and if it is expressed by gradation as by a thermometer, &c. that then *a part* of that quantity in the same body must shew the same degree as the whole, or to express its gradation at all must be a philosophical solecism. Steam I chuse to define, a dry, invisible, elastic fluid, formed by water in a boiling state, by the application of free caloric in what manner so ever it be applied. I say *dry*, because it is proper to correct a vulgar error in the notions

tions which are generally formed of steam, by observing it discharged from certain vessels of boiling water which is usually denominated *steam*, in which state it does not answer to either of the characters given above, *viz.* neither *dry*, *invisible*, or *elastic*, and must be called something else; and with humble submission I would call it vapour, and it becomes so by getting in contact with the cool air of the atmosphere.

By latent heat in steam I am to understand such a combination of caloric forming this dry elastic fluid, as is utterly inappreciable by the thermometer, while the thermometrical temperature is at 212°, or such as is common under the pressure of the atmosphere near the level of the sea. There are also two other terms which I have need to define, lest I may have misunderstood them, namely, *specific caloric*, and *capacity for caloric*, and these are said to be synonymous, and if so, I will take the liberty to chuse the latter by which to express my notion of the power or aptitude or disposition in bodies, to observe or take up this caloric, without offering any reason as to how or why it is that some bodies have a greater capacity than others; and as I observe very different conclusions drawn respecting it, I may safely infer that other people can be puzzled about it as well as me; for some affirm that it is *matter*, and call it the *matter of heat*; and there are others who contend that it is not matter at all, and by direct inference must be *nothing at all*. But whether nothing at all can set on a blaze two pieces of wood which are rubbed hard against each other, or whether nothing at all can set fire to a heap of damp corn, or a stack of hay, or make cold water begin to boil when thrown on quick lime, *let wise men judge*. And if we take it up and associate it with the doctrine of affinities, will we have recourse to it as an agent in these accidents

and

and changes of bodies, for two pieces of wood may lie in the forest until they are rotten, and corn and hay when laying in the field will be as little disposed to heat as a bar of iron or a block of marble, and that which works thus secretly in nature, we have agreed to call caloric or the matter of heat.

However, there are no such secrets in its operation on steam, for here it is all plain and above board, and one of the experiments to confirm the doctrine of latent heat is as follows.

Mix, say they, 100 gallons of water at 50°, with a gallon of water at 212°, the temperature will be raised about 1½°. Condense in a common still tub one gallon of water from the state of steam by 100 gallons of water at 50°, the water will be raised 11°, hence a gallon of water condensed from the state of steam raises the temperature of 100 gallons of water at 50°, 9½° more than a gallon of boiling water, and by an easy calculation it appears that the caloric imparted to the 100 gallons of water by the gallon of steam, if it could be condensed in one gallon of water, would raise it to 950°.

Another experiment I take from Henry's Epitome, in which he observes that caloric becomes latent during the formation of steam. Two cylindrical flat-bottomed vessels of tin five inches diameter, and containing a small quantity of water at 50°, were placed on a red-hot iron plate; in four minutes the water began to boil, and in twenty minutes it was all boiled away; in four minutes, therefore, the water would receive 162° of temperature, at 40½° each minute. If we suppose, therefore, that the heat continues to enter the water at the same rate during the whole ebullition, we must conclude that 40½°×20= 810° have entered the water and are contained in the vapour. Another experiment exactly similar to this I could

could have cited from Dr. Black, but do not think it necessary.

But neither of these experiments will support the doctrine of latent heat in steam; I mean that there is nothing conformable to the explanations of the terms given above. That an abundance of caloric has passed through the water is admitted, and according to the last experiment is gone along with the water all boiled away; that is to say, this abundance of caloric has elevated the temperation of the water to such a degree that it is become volatile, and the water and the caloric have escaped into the atmosphere together. But if, as in the first experiment, this volatile water had been brought into contact with a quantity of cold water, or any cold body to which a proper instrument may have been applied, it would have parted with its proportionate degree of caloric, and the instrument would have shown the precise temperature of both, *of uncombined caloric.*

For notwithstanding all the address in conducting and detailing the experiment, no latent caloric has been brought into the account.

It is remarkable that the advocates for this opinion have successively been aiming to establish an incontestible precision in the results of their experiments, but are constrained to be satisfied with approximations at last; for here in the first experiment the quantum of heat is determined 950°; and another experiment brings it 954°; and that above by Dr. Henry makes it 810°; and Mr. Pictet says it is =800, and Mr. Watt shewed it was 920°.

I will make every allowance for disappointments in conducting experiments where a mathematical precision is sought for; but the difference between Mr. Pictet and Dr. Black is inadmissible.

I remem-

I remember when M. de Luc was giving evidence in the cause of Bolton and Watt against Bull, that he stated that it required six times as much caloric to evaporate a quantity of water as it would to bring it to boil, without fixing any precise temperature at the commencement, so that if it was 62° or 32° it seemed not to signify.

However, it is affirmed that 954° of caloric have passed into the water, and that it is contained in the vapour, which in correctness of expression is not true, but if I admit it, it will not prove the position. If any thing were to be proved that may be proved, it should be that so much caloric has entered the water, and that it has escaped, or it is there still: the latter cannot be, and I hope I shall not be accused of quibbling if I ask where then? the answer must be, *gone mixed with the atmosphere, while the steam* is no more.

Well, but suppose it had been detained in a vessel capable of preserving its temperature, then I say you would find it at 212°: yes, you would say, that is the thermometrical temperature, but it has received 954°; granted, as to the aggregate quantity of its particles; but when we apply the term heat, whether latent or exposed to a body, it is to be understood as applicable to *a part* as to *the whole,* and therefore, a cubic inch of any body containing it must have the same degree as the whole mass. And will it be said if I take from this aggregate quantity of steam a cubic foot, for instance, that that cubic foot contains 954° of latent caloric, when you have stated that 10,000 cubic feet contain but the same quantity?

To be more particular; I will take two vessels capable of containing eight or ten atmospheres; in one the steam shall be generated, and in the other collected (preserving their temperature); and let a thermometer constructed

 for

for high temperature be placed in the last or either of them, will it be said that the thermometrical temperature, all the while the experiment is going on, shall be no more than 212°, or will it not indicate the whole of the caloric taken up by the water? and if so, *where is the latent caloric?* The whole of the above experiments then amount only to this, namely, that by them we obtain the quantum of caloric required to generate a certain volume of steam from a given quantity of water.

I am under some necessity of apologizing for the tedious præcognita of this paper, as it was suggested to me by a friend whose judgment I highly respect, but I could not comply with his intimation on these accounts: first, as I am no chemist, it is but proper that I should shew how I accept those terms which relate to this matter, for fear I may have mistaken their true acceptation; and secondly, because they will afford some information to any other tyro in the study of the subject.

Yours, &c.

Klippa, near Gotheborg, J. C. HORNBLOWER.
February, 1813.

On the best Method of constructing a Peach House.

By THOMAS ANDREW KNIGHT, *Esq. F. R. S. &c.*

With an Engraving.

From the TRANSACTIONS of the HORTICULTURAL SOCIETY of LONDON.

I SENT to the Horticultural Society, in 1808, a description of my vinery here, which I supposed to be so constructed as to receive the greatest heat, with the least expenditure of fuel, and to admit the greatest quantity of light, through the least extent of glass, at those

those seasons of the year when light is wanted: and I then expressed a hope that some other members of the society would give plans for the proper construction of forcing houses, for other purposes. But as this has not been done, I take up my pen to offer some observations on the most advantageous form and dimension of a Peach House.

Another gentleman, the rev. Mr. Wilkinson, has, however, subsequently undertaken to prove that the inclination of roof, which I have recommended, is, by no means, the most advantageous; and it will therefore be necessary for me first to answer the objections he has stated *. For silence, on my part, relative to those objections, would appear contemptuous, if I persist, as I do, in retaining every opinion, which I have given in that paper; particularly as the small deviation from my former plan for a vinery, in that I now recommend for a Peach-house, is in diametrical opposition to the theory and opinions of Mr. Wilkinson.

Mr. Wilkinson's first position is that "we want the genial warmth of the sun most in the spring:" he thinks about the sixth of April †. The fires in a vinery rarely are, and never ought to be, lighted before the middle of February; and the application of heat ought then to be slow and gradual. The leaves will consequently be young and tender in the beginning of April, and will be very ill calculated to be suddenly exposed as they often must be, by the removal of intervening clouds, during the rapid

* See the Horticultural Transactions of 1809.

† Theoretical writers on vegetation are extremely apt to transfer some of the habits and feelings of animal life to plants; whence have arisen the frequent recommendations of poor soils, and cold situations, for nurseries; the writers feeling how agreeable it is to go from worse to better, and how disagreeable the contrary.

rapid variations of weather, and of temperature, in the end of March, and the beginning of April, to the full influence of the sun, falling vertically upon the glass. The wind is also often so cold, when the sun shines very brightly, at that season of the year, that much air cannot always be admitted without injury to those plants, with which it first comes into contact; and therefore, if very great attention be not paid by the gardener, the tender leaves and young shoots of the vines will be often injured; and indeed the young leaves and shoots sometimes fade much in my house, during hot days in the beginning of April, though the light does not fall vertically on the roof before the 20th of May. But waving wholly this objection, the stimulus of more light, than can subsequently be given, is always exceedingly injurious, in unnecessarily expending the excitability of the plants. Every year's experience shows how much better seedling plants grow in spring than in autumn. In the former period the intensity of light is increasing; in the latter it is decreasing, as it would be in a house constructed according to Mr. Wilkinson's recommendation, as far as inclination of roof would operate, from the 6th of April to Midsummer.

Mr. Wilkinson's next objection is, that the inclination of roof, which I recommended, admits most light and heat when they are "*least requisite.*" Every gardener must know, I thought every man had known, even he who stands behind the counter in the obscurest alley in London, that fruits are always best, when heat and light are very intense during the period in which they are ripening, and that heat and light are then *most requisite.*

But it is not on the 21st of July only, that an inclination of roof of 34 degrees admits most light. I contend that the reflection of light continues to diminish, as the solar

solar rays fall more perpendicularly, and that this inclination admits more light, between the 20th of April and the 20th of August, than any other whatever. During this period the vines blossom and ripen their fruit, in a vinery: they also form the buds, and blossoms, for the succeeding season; and within the same period they probably generate the sap which feeds the blossoms, and leaves, and young shoots, of the following spring*. On the 4th of September the leaves in a vinery are nearly out of office; and a vertical sun can do little at that period, but wither the remaining crop of mature fruit.

Mr. Wilkinson's last objections are, that my vinery admits but very little light at the winter solstice; and that the reflected rays are then "nearly the most possible, which they actually would be if the angle were depressed only 6 degrees more†." I wish Mr. Wilkinson had stated the amount of the beneficial influence of the solar light and heat, upon vines when they have no leaves, and when the powers of life, in them, are nearly in a state of perfect repose. I have always observed, as many others have also done, that all plants, which, like the vine, are capable of bearing a very low temperature without injury, never vegetate so strongly in the spring, as when they have been, during winter, long covered with snow: for under such circumstances, and after so long and almost total suspension of vital action, the powers of vegetable life appear to become extremely excitеable; and therefore I should be happy to find Mr. Wilkinson's calculation correct. But the solar rays fall vertically on the roof of my vinery, when the altitude of the sun is fifty-six, as he states; and the altitude of the sun in the latitude of this place exceeds fifteen at the

* See Phil. Trans. of 1805. Part I.

† See Mr. Wilkinson's Paper, in the Hort. Trans. of 1809.

winter

winter solstice. The angle of incidence does not therefore appear to me to be so much as 41, nor the reflected rays (according to Bouguer's table) quite 35 out of a thousand, instead of being as Mr. Wilkinson states "nearly the most possible;" and I am quite at a loss to comprehend how the angle of incidence can be 87° 30 when the inclination of the roof of a vinery is 6 degrees below 34, that is 28, and the altitude of the sun more than 15.

I therefore venture to conclude, though I confess myself to be much less skilled in mathematics than in horticulture, that Mr. Wilkinson's calculations are erroneous. I enter into the controversy with reluctance, and (believing that both of us have only one object in view, that of advancing the science of horticulture) I hope it will here end. Nevertheless if I err in any of the positions stated, I shall be happy to be better informed by Mr. Wilkinson, or any other gentleman. I now proceed to offer my opinions on the most advantageous form and dimensions of a Peach-house.

Scarcely any fruit can be raised in greater abundance, or with fewer chances of failure, than the Peach in a forcing house; where the insects, which often prove so formidable in the open air, are easily destroyed, and where the tree is subject to scarcely any other disease than the mildew, and I have reason to believe that the appearance of this disease may, in general, be very easily prevented by selection of proper soil, and proper management. But though a crop of Peaches or Nectarines is very easily obtained under glass, experience seems to have proved that neither of these fruits acquire perfection, either in richness or flavour, unless they be exposed to the full influence of the sun, during their last swelling, without the intervention of the glass. It has consequently

quently been the practice, in my garden, to take off the lights wholly before the fruit begins to ripen; and in warm seasons, and favourable situations, this mode of management succeeds perfectly well. But in the colder parts of England this cannot be done; and if the weather, in any part, prove cold and wet, just after the lights are taken off, the growth of the fruit is suddenly checked, and its quality greatly injured: and I have never met with the Peach in so much perfection, as when it has been raised in a house where it could be conveniently exposed to the sun in warm and bright days, and secluded from the cold night air, and rain; which mode of management can, I think, be adopted most conveniently in a house constructed according to the annexed sketch and dimensions, and the following directions.

As the lights, to be moved to the required extent, with facility, must necessarily be short, the back wall of the house must scarcely exceed nine feet in height; and this height raises the rafters sufficiently high to permit the tallest person to walk with perfect convenience under them. The lights are divided in the middle, at the point A, Fig. 7, (Plate IV.) and the lower are made to slide down to the point D, and the upper to the point A *. The flue enters on the east or west end, as most convenient, and passes within six inches of the east and west wall; but not within less than two feet of the low front wall; and it returns in a parallel line through the middle of the house in the direction either east or west, and goes out at the point at which it entered. The house takes two rows of Peach or Nectarine trees, one of which is trained on trellises, with intervals between for the gardener to pass, parallel

* A bar of wood must extend from D to B opposite the middle of each lower light, to support it when drawn down.

with

with the dotted line C. These trees must be planted between the flue and the front wall; and the other row near the back wall, against which they are to be trained.

If early varieties be planted in the front, and the earliest where the flue first enters, these being trained immediately over the flue and at a small distance above it, will ripen first; and if the lower lights be drawn down in fine weather, to the point B, every part of the fruit on the trees which are trained nearly horizontally, along the dotted line C, will receive the full influence of the sun. The upper lights must be moved, as usual, by cords and pullies; and if these be let down to the point A, after the fruit on the front trees is gathered, every part of the trees on the back wall will be fully exposed to the sun, at any period of the spring and summer, after the middle of April, without the intervention of the glass. A single fire place will be sufficient for a house of fifty feet long; and I believe the foregoing plan and dimensions will be found to combine more advantages, than can ever be obtained in a higher or wider house*.

Both the walls and flue must stand on arches, to permit the roots of the trees to extend themselves in every direction, beyond the limits of the walls; for whatever

* The inclination of the roof is depressed 6 degrees below that of my vinery; because the lights will always be drawn down at, or before, Midsummer, and till near that period the solar rays will every day fall more and more perpendicularly on the roof; and the lower lights can, with this inclination, be drawn down to the point B without coming into contact with the ground. If Mr. Wilkinson's calculations be accurate, this inclination of roof will, at the winter solstice, however, reflect the "most" rays "possible;" but he reckons the angle A E F to contain forty degrees more than are marked on my quadrant.

be

be the more remote causes of mildew, the immediate cause generally appears to be want of moisture beneath the soil, particularly if it be combined with excess of moisture, or dampness, above it. In experiments which I have made to discover the cause of mildews, in other plants, I have found that nothing so effectually prevents its appearance as abundant moisture beneath the soil; and many gardeners, who have had the misfortune to cultivate the Peach in situations where the roots at a small depth beneath the soil were destroyed by water during winter, or where the same effect was produced by the unfavourable nature of the subsoil, must have observed the injurious effects of mildew. It is my intention to send to the Horticultural Society, at a future time, some observations upon the means of preventing this disease.

I shall conclude my paper with observing that I have never seen the Peach in so great a state of perfection, as when cultivated very nearly according to the preceding directions: and I estimate so highly the advantages of bringing forward the fruit under glass, till it is nearly full grown, and then exposing it to the stronger stimulus of sunshine, without the intervention of the glass, and excluding it from rain and dews, that I believe the Peach might be thus ripened in greater perfection at St. Petersburg, in a house properly adapted to the latitude of that place, than in the open air at Rome, or Naples.

Description of an Instrument for firing Cannon, by which a number of Cannon may be fired in quick succession without the necessity of a Match.

By Mr. N. Douglas, *of Chiswell-street.*

With an Engraving.

From the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce.

The Silver Medal was voted to Mr. Douglas, *for this Invention.*

I HAVE sent, for the consideration of the Society, an instrument of my invention for firing cannon. In adopting it, for the use of merchant vessels, it would obviate the great inconvenience of the slow match, and the trouble and delay which I have frequently witnessed in making a poker red hot in order to fire a gun. The gun-locks, which are partially used on board men of war, would be attended with great inconvenience to be used in trading vessels. One of the many advantages which my instrument possesses, is the quickness with which a gun may be fired with it, when the object is found in a right line with it, and the ship in motion. The price of one of these instruments will be about 8*s.*; it is simple in construction, and certain in effect; and it is probable its use on board merchant ships would prevent many from being taken by an enemy, as one or more instruments would scarcely take up any room, and be ready always for immediate use; and one instrument could be employed, in quick succession, to fire many cannon.

Reference to the Engraving.

This is proposed to be employed as a substitute for the match, in firing cannon, being more expeditious, and less dangerous. The large ships in the royal navy have,

have, for some years past, been provided with locks to their cannons, and have found great benefit from the change, in avoiding the dangers of so many matches which, in an engagement, were blazing in every part of the ship, and very likely, if thrown down by carelessness, to set on fire or blow her up. Merchant's ships have not been able to adopt this plan, on account of the expense, and the danger of locks being out of repair, when they are exposed, as their guns must be, on the open deck. Mr. Douglas's invention will be found of great use in these cases: it will apply to any gun as readily as a match, but will require no preparation for use, being kept below, and ready for service at all times. It is a spring lock, on a new construction, which is fixed at the end of a handle, and being held above the priming of the gun, throws sparks upon it when discharged by its trigger.

Fig. 1 (Plate VIII.) is a view of its whole length; and Fig. 2, a section, on a larger scale, shewing the interior parts detached. The same letters apply to both. A A is a wooden handle, made hollow, to contain the other parts: but to give access to them for repairs, it is made in two halves, which are united together by twine bound round them near their two ends; the parts within the handle are shewn at Fig. 2. Here B B is a brass tube, into which a square iron rod C D is fitted, and slides freely; from this a long cylindrical wire *a* proceeds, and passes through a hole in the extremity of the tube, which also contains a helical spring, formed of strong steel wire, wrapped round, and constantly tending to throw the rod forwards out of the tube. At the extremity D of the rod is a kind of vice, which, by means of two screws holds a flint *b*; this when thrown out by the action of the spring, strikes against a piece of steel,

E F, which may be called the hammer, as it performs the same office as the hammer of the common lock; it has a stem, or tail, screwed fast to the outside of the brass tube, by two screws, at F, and is thus always held opposite to the flint *b*. The trigger is situated at the other end of the handle: it is a catch, G *e*, moving on the centre, and pressed by a spring, situated under the end *e*, so that the hook G, at the other end of it, is always in contact with the wire *a*; and when this is sufficiently drawn back, the hook falls into a notch in the wire, and retains it until the instrument is to be discharged, by pressing the thumb upon the button *e*, at the end of the trigger; the spring then throws the rod forward very rapidly, and the flint at its end strikes the hammer, and produces sparks sufficient to ignite the priming powder upon the touch-hole of the gun; the instrument being held immediately above it for that purpose.

It may be charged again in an instant after using; to do this the finger and thumb are applied to the projecting extremities of a short wire H, fixed across the other perpendicularly, and coming through the opening H, Fig. 1, and another on the opposite side; by this the rod and flint is sufficiently drawn back for the hook of the trigger to catch and retain it, with the spring in its charged state, ready for use. The inside end of the piece of steel E, or hammer, on which the flint strikes, is made inclined to the length of the handle, and curved, as the figure shews, so that the flint will strike obliquely upon it; to increase the effect the stem F is made yielding, like a strong spring, so that the hammer E falls back, in some degree, when struck by the flint, to act like the hammer of a common lock: by which means it produces a greater fire than if it struck upon a fixed hammer it thus scraping off the ignited particles of steel produced by the stroke.

Description

Description of a cheap Wooden Forcing-Pump, to raise Water from deep Wells. By Mr. JOHN STEPHENS.

With an Engraving.

From the TRANSACTIONS of the SOCIETY for the Encouragement of ARTS, MANUFACTURES, and COMMERCE.

The Silver Medal was voted to Mr. STEPHENS *for this Communication.*

I HAVE sent for the inspection of the Society a cheap pump, of my invention, by which I draw water from a well 66 feet below the surface of the ground. I think this pump will be very useful in the country, where the water in wells is too deep for common pumps. I consider it to be the best and cheapest wooden pump in use, and the greatest part of it may be made by any common carpenter.

The whole expense of this pump and apparatus was 25*l.* and it raises the water 66 feet high. The lower part of the pump-tree is four inches in the bore. The lower part of the rod which passes through the stuffing box is made of brass; the elbow and upper pump-trees are of a two-inch bore, and may be easily made of any kind of wood. It may also be made to act as an engine for extinguishing fires, by the addition of an air-tight vessel and pipe to its upper part.

Agreeably to your desire I have put the experiment of my pump in practice. By the power of two men I throw water easily to the height of 18 feet above the surface of the ground, and with a pretty regular stream. I could have thrown it higher if the engine pipe had not been too large. This I consider as a useful method of watering gardens

gardens or roads, or to extinguish a fire, if it should happen near to a pump of this kind. It will also fill a cistern at any moderate height.

I have introduced in the drawing a cap and screw, in preference to screwing it to the nossel of the pump, as it is stronger and more to be depended upon; and I would recommend a screw when water is to be raised to a great height, to be made to fit the nossel, that every thing may be ready always for immediate use. The work of this pump is not liable to be injured by frost. Where the well is of considerable depth I would recommend a brass or metal barrel for the piston to work in.

These pumps may be useful for ships, in preventing fire on board. It has been suggested, that cast-iron pipes would answer better, and be cheaper than wooden ones; but this can scarcely be the case, when it is considered the little expense at which these pipes may be made from fir and elm boughs, or beech poles. I have been told, by Mr. George Sims, a person in the habit of making pumps, that he has known beech pump-trees to last sixty years and upwards.

I shall always be ready to give any further information that may be desired upon the subject.

Reference to the Engraving.

Fig. 3 (Plate VIII.) is a section of a well, in which a pump of this kind is fixed; A A, represents the surface of the ground, and B B, the brick-work of the well, in which the water stands at the level C, and is, by the pump, to be raised to the surface A A.

D is the lever or handle of the pump, which has the rod *a* jointed to it, and descending to the pump; the rod is made of wood, in several lengths, which are united by joints

joints of iron, in the manner shewn at Fig. 6; the wooden rods, *a a*, being capped with iron forks *b*, which include the ends of them, and are rivetted fast; the ends of the forks are jointed together to connect the several lengths.

E is the working barrel, or chamber, of the pump, in which the bucket works; this part is formed of a tree, bored through, and having a projecting branch *e*, which is likewise bored obliquely to the barrel, and forms the forcing pipe; in the bottom of the barrel, the suction valve is situated, being at the top of the suction part of the pump, which is bored with a smaller auger than the working chamber, which is also lined with a brass tube, where the bucket works. The top of the barrel is covered by a metal lid *g*, (see also Figs. 4 and 5), which has a stuffing box in the centre to receive the metal cylindrical part of the pump rod *h*; to the lower extremity of this the bucket *d* is fixed. The metal lid consists of a ring, which is screwed to the wooden barrel by five screw-bolts, passing through as many ears, projecting from the circumference of the ring; they have eyes below, to hook upon pins, which are fixed in the wood, but project sufficiently for these bolts to hold, and are formed into screws above, so as to hold the ring firmly down, by means of nuts screwed upon them. The moveable lid of the pump, which has the stuffing-box *g* formed in the center of it, is screwed to the ring, by five screws, and these can be taken out to remove the lid, and draw up the bucket when it requires to be leathered.

F is the forcing pipe, formed of as many pieces of wooden pipes as is required to make up the length; they are united together by making the upper ends conical, to enter a similar cavity, made in the lower end of the next pipe; the lowest piece fits upon the extremity of the projecting branch *e*, and a valve is proposed to be put in

in the pipe, at this joint, to prevent the return of the water, and bear part of the weight of the column from the lowest valve at *f*; the upper length of the pipe has a spout *i*, at which the water is delivered.

M is a second spout, fixed into the pipe lower than the former; it has a screw, by which it can be united to a hole, or leather pipe, to convey the water to a distance: or by means of a jet, or branch-pipe, to throw it in the manner of a fire engine; in this case the upper spout *i* must be stopped up, by a screw plug or cap; and there is a copper air-tight vessel H, situated at the top of pipe F, to equalize the pulsative motion of the water, as thrown by the pump.

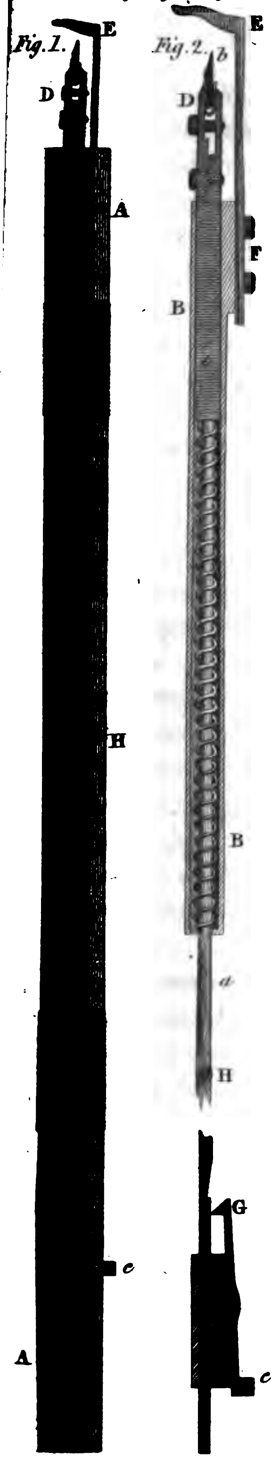
k is a bracket fixed to the pipe F, and projecting over the center of the pump, where it has a hole to receive the pump rod *h*, and guide it steadily in its motion up and down, that it may not wear the stuffing box away on one side. As the wooden tubes of which the forcing pump F is composed may be made from waste or crooked timber, it makes a great difference between the low price of such, and that of the straight trees necessary for common pumps.

A wooden plug may be chained to the pump, betwixt the spouts or nossels M and *i*, so as to be ready to stop that which is not wanted in use.

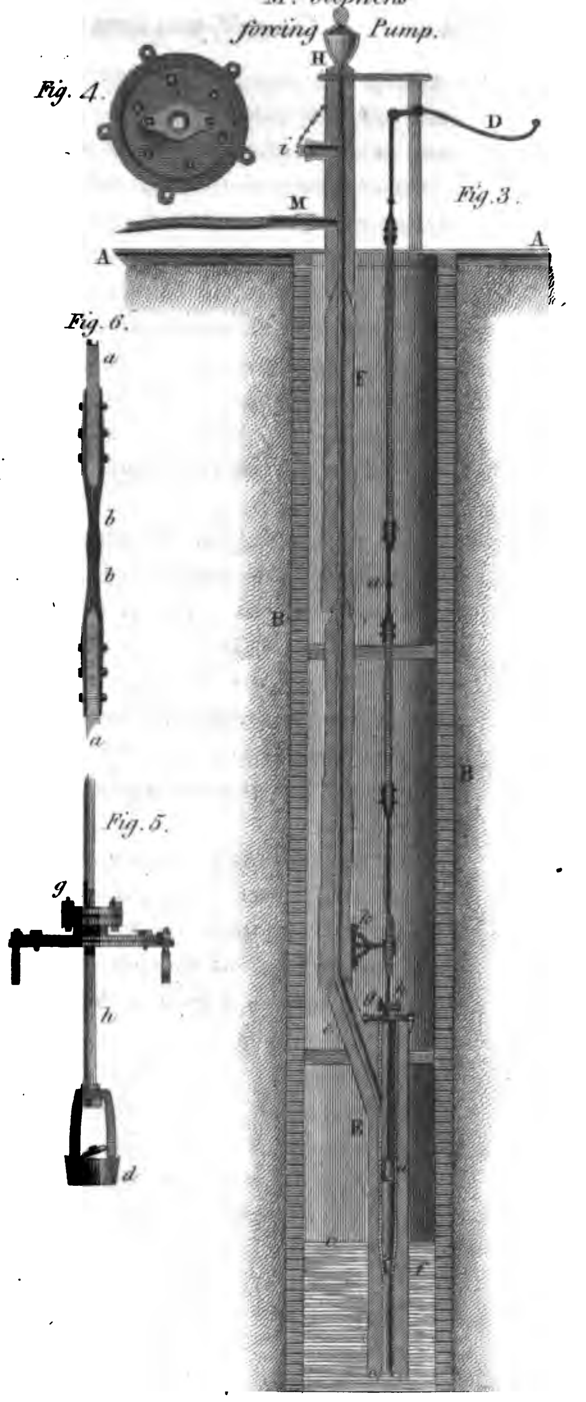
Mr. Stephens is of opinion, that it is better to place the valve *f* above the level of the water in the well.

Guage

Instrument for firing Cannon.



Mr. Stephens forcing Pump.



Description of a Guage for the Purpose of marking a Line along the Centre of any Parallel or inclined Surface; also for finding the Centre of a Circle, Square, or any regular Polygon. By Mr. H. R. Palmer, *of Mare-street, Hackney.*

With Wood Engravings.

From the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce.

The Silver Medal was voted to Mr. Palmer *for this Communication.*

HEREWITH you will receive a guage which I have invented, for the purpose of marking a line along the centre of any parallel or inclined solid, which I beg to introduce to the Society of Arts.

It has been approved by several workmen, to whom I have shewn it. It will mark a centre line with great accuracy, and it is more easy for a workman to measure from a centre line formed. It will assist greatly in making mortices, and will answer also all the purposes of a carpenter's common guage. It will cost about four shillings.

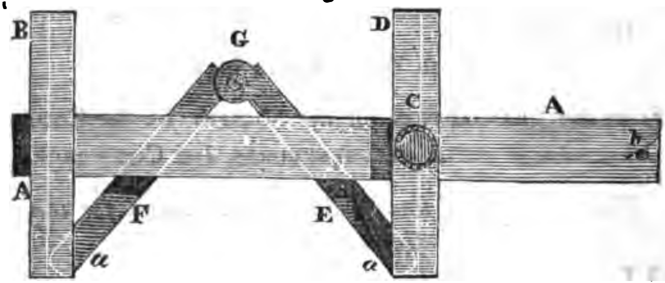
Reference to the Engravings.

Fig. 1 is a plan, and Fig. 2, a perspective view of the guage, the same letters refer to both figures, the first being drawn at exactly half the real dimensions of it. A A is a square bar of hard wood planed straight, having the two cheeks of wood B D fitted tight upon it, the cheek B, is fixed fast on the end of the bar, whilst the other slides freely upon it, but may be clumped fast, at any required place, by the thumb-screw C; at the end *b*, a common scribing point is fixed in the bar,

 and

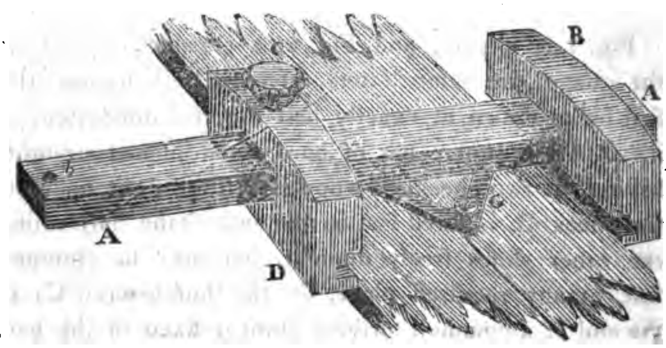
and with this, and the sliding piece D, it forms the common gauge used for describing parallel lines from the edge of any piece of wood-work; the addition made by

Fig. 1.



Mr. Palmer consists of two brass arms E and F, of equal length, which are centered in the two sliding-boards, or cheeks, at *a a:* the other ends are jointed together by the screw G, which is formed into a sharp point beneath to mark the work with. In using this guage, its two cheeks B D must be set to the width of the piece of wood intended to be scribed and applied, as shewn in Fig. 2; it must be evident, that the point of the screw G, will always keep in the centre between the two cheeks B D, because the two arms E F, are of equal length, and

Fig. 2.



a line

a line joining their centres *a a* is perpendicular to the cheeks; it may also, as before stated, be used in the manner of the common carpenter's gauge by means of the sliding cheek D, and the marking points projecting below the bar at *b*. This tool will prove much more expeditious in use than the usual method practised by carpenters for finding the centre of any piece of board, &c. *viz.* by setting the common gauge, as near as can be estimated, to the centre of the piece, and making a mark, and then turning it to the opposite side of the piece, and making another mark, between which, if the distance is made very small, will be found the centre, near enough for common purposes.

If the piece of work to be gauged is not parallel in its width, then the screw C must be loosened, and the two cheeks kept pressed together with sufficient force to keep them in contact with the two sides of the work, when the point G will traverse along the centre as correctly as if it was parallel; because, in all situations it preserves an equal distance between the two cheeks. The two cheeks have grooves in them to admit the brass arms E and F, when the cheeks are brought into contact.

On a Remedy against the Ravages of the Fly on Turnips, and Swedish Turnips. By Thomas Greg, *Esq.*

From the Communications of the Board of Agriculture.

As the Board does me the honour to request I should make known to them the experiments I have made with lime, under the directions of the earl of Thanet, particularly how and when it should be slacked, and how and when applied,—I shall, in conformity to their request, give in detail my own experiments thereon.

 I had

I had the honour of paying lord Thanet a visit early in the spring of 1811, at which time he had began to sow Swedish turnips.

On that part of the field which his lordship mentions as having failed, the application of lime was omitted, at my particular request, the better to demonstrate the infallibility of the experiment.

Upon my return to Coles, I ordered lime to be laid upon the headlands, proportioning the quantity to the length of the lands.

The weather was fine, and the lime did not fall by the atmosphere, but was slacked as used, and sown by hand over a 40 acre piece of land.

I ordered every day's sowing to be watched, and the lime to be applied as soon as the turnips came up, in the same daily rotation as they were sown, which was 5 acres *per* day.

But as lord Thanet properly observes, "to have any experiment made, you must see it done." This remark was verified, by the neglect of the bailiff in my absence, who delayed spreading the lime on the first and second day's sowing, until the third day's sowing was ready; which delay and mistaken economy in labour, exposed the first day's sowing to the ravages of the fly.

But this circumstance I cannot lament, as it furnished additional proof of the efficacy of the lime, and procured the correct execution of my orders upon the remainder of the field, which 35 acres were covered with healthy plants.

In the year 1812, I repeated the same process, with the same success; and I have not the least doubt, but lime is an infallible protection to the infant turnip, if rain does not immediately succeeding the sowing. If it does, on the return of fair weather, I should recommend a repetition.

The

The casting of lime by hand produced considerable inconvenience to the men, in consequence of which the work was not well performed: however, under that disadvantage, the turnips sown upon 40 acres of land, in 1811, were so abundant, as to support 500 down sheep, about 6 cows, and 30 hogs, until May, 1812; and the crop of 1812, consisting of the same number of acres, will, I have no doubt, support an equal stock to the same period.

Impressed with the importance of the application of lime, and finding it necessary to deposit it with great accuracy, I turned my mind to machinery to effect that purpose.

Without troubling the Board with a detail of experiments, it is with great satisfaction I am enabled to inform them, that by adding an horizontal motion into the top hoppers of a common drill, and substituting small shovels instead of cups into the lower, I produced a regular discharge of the lime.

For dusting turnips in rows, the common seed tin pipe may be used. For broad-cast, they are taken away, and a board, about 18 inches wide, substituted in their place.

This board must hang upon an inclined plane, and should be tinned, to facilitate the fall of the lime.

When the atmosphere is damp, the lime will hang upon the board, unless a concussive motion is given to the board, by a crank.

The lime should not be slacked or sifted until the apparatus for sowing it is in the field; for the least damp will change it from a prepared state of powder, and interrupt a regular discharge.

It is not at present in my power to make any further observations to the Board upon this very important branch of agriculture.

The

The pride I feel in having introduced that invaluable plant, the ruta baga, into England, in the year 1783, will be much increased, should my subsequent endeavours be instrumental in protecting and facilitating the cultivation of a plant for which I must naturally feel a kind of parental interest.

Notice upon Alcohols or Spirituous Liquors, and on the Changes which they undergo by their Rectification with alkaline, saline, and earthy Matters, &c.; followed by a simple Process for obtaining the most dephlegmated Spirits of Wine, without altering its constituent Principles. By M. Dubuc.

From the Annales de Chimie.

During more than two centuries intelligent men have successively proposed different methods of taking from common brandy a certain quantity of water, of malic acid, and other foreign bodies, which it obstinately retains, in order to reduce it to its most simple elements, to compose a liquor known by the name of alcohol, or highly-rectified spirits of wine.

But it is about one hundred years that Boerhaave, Cartheuser, Sthal, and other chemists, occupied themselves with this object, and that, by means of their processes, this fluid has been obtained almost entirely freed from the heterogeneous matters which alter or debase its properties. Of all the methods indicated by the ancients, that of Lemery appears still to obtain the preference; it is known that it consists in distilling in a vapour-bath brandy, at 22 degrees, in a matras with a very long neck, furnished with a cap, &c.

The alcohol thus distilled, or that extracted by similar methods, marks in general from 38 to 40 degrees of the ordinary

ordinary hydrometer, which is a temperature of from 5 to 12 centigrades: this liquor, when it has attained a certain specific gravity, is named by Beamé "highly-rectified spirits of wine." Its physical and chemical properties, besides its specific gravity, are those of being perfectly diaphanous, volatile, very inflammable, of burning without smoke, having an agreeable odour, a warm taste, and not altering the aqueous tinctures of turnsol, nor those of the petals of violets.

Such are the characters that should essentially distinguish all alcohol, extracted either from wine, cyder, perry, rum, &c. when well rectified, and deprived of the water and malic acid, which is met with almost always in weak spirituous liquors.

By means of salt, or alkaline, and earthy matters, alcohol may be brought to a higher state of rectification, as much as to 46 degrees and more of the äerometer; but it appears that these matters uniformly act more or less on the elements of the spirits of wine during the distillation, for the liquor resulting from it has new properties, since it acts differently with the re-agents, and the spirits of wine obtained without an intermedium, such as that prepared by Lemery's process, which we shall henceforth denominate *pure alcohol.*

Lowitz, Richster, and other chemists, have successively proposed different substances, which have a great attraction for water, in order to dephlegmate the alcohol completely. Indeed, if the matters mixed with the spirits of wine only seize on the aqueous principle that it contains in excess, so that it does not arrive at the highest term of rectification, we may conceive what immense advantages may be derived from these processes in the arts and in the commerce of spirituous liquors; but the series of experiments that we shall relate will end all uncertainty

certainty in this respect, and even enable us to appreciate the methods hitherto proposed for the rectification of alcohol. We shall shew that each saline intermedium alters or debases the spirits of wine more or less, whether it acts on its constituent principles, or is dissolved in it, or even interposed in a state of extreme division.

The matters that have been alternately employed in these operations, or in the dephlegmations of the spirits of wine, are, 1st. the two fixed alkalies; 2d. muriate of lime; 3d. muriate of potash; 4th. quick lime; 5th. plaster or calcined gypsum; 6th sulphate of soda; and, recently, acetate of potash, melted and reduced to a powder.

In consequence, I have successively distilled *pure* spirits of wine, of from 38 to 40 degrees, with these different salts, by exactly following the processes indicated. This alcohol, when rectified with the alkali of tartar or soda, whether caustic or partly carbonated and very dry, loses indeed from three to four degrees of its specific gravity: after this proof its odour becomes more subtle, but it loses its natural mildness. It renders green the aqueous tincture of violet petals and the juice of buckthorn; it, besides, precipitates abundantly the water of wells charged with calcareous sulphate, which demonstrates that spirits of wine, rectified by alkalies, is altered in its elements, or has received an addition of some heterogeneous principle.

Pure alcohol, rectified by the muriates of lime and potash, slightly calcined, acquires also some degree of lightness, and even more than with the alkalies, but the liquor proceeding from it equally acquires new properties, which are not those of good alcohol, since it differs in having a warm, bitter and sharp savour. It is easy to shew the presence

presence of the salts employed in its rectification, either by ammonia or the nitrates of silver and mercury, &c.

Quick lime, grossly pulverised and mixed with pure alcohol, becomes sufficiently heated to allow a portion of the fluid to distill without employing external heat; and this product exhibits signs of alcalicity by acting sensibly on the aqueous juice of black plums. The residium distilled in a water-bath contracts still more the alkaline property, and becomes instantaneously cloudy on mixing it with ordinary water, saturated with carbonic acid; it is easy, by putting the liquor into a large conical glass, to find at the bottom of the vessel, after two days rest, a tolerable quantity of carbonate of lime, &c.

Pure alcohol, distilled upon calcined gypsum, loses also something of its specific gravity, not however so much as with the four preceding substances; the spirits of wine that proceeds from it contracts a particular and disagreeable odour; it besides much weakens the colour of the infusion of poppy flowers, whereas pure alcohol heightens it; it communicates also the colour of dead leaves to the tincture of violets; all which properties indicate its adulteration, or the presence of a foreign body in the spirituous fluid. Glauber's salts, or sulphate of soda, calcined, and completely deprived of its water of crystallisation, appears an excellent intermedium for completely dephlegmating the alcohol without acting upon its elementary principles. I have several times repeated this operation with success; and I have always obtained, by employing one part of this salt, pulverised, upon two of liquid, at 36, 37, and 38 degrees, a spirit of wine, marking from 38 to 40 degrees, and which had all the properties of that prepared without an intermedium; but, notwithstanding its agreeable odour, it holds in solution a small quantity of the saline matter employed in its distillation;

tillation; for pure barytes occasions a slight precipitate. It was easy afterwards, by means of the blue vegetable colours, to discover in it the presence of the alkali, disengaged by the union of the sulphuric acid, united with the heavy earth.

By a second rectification on the same calcined salt, the alcohol may be obtained at 42 degrees; but it would be useless to attempt to give it less specific gravity by other distillations: this liquor, as we have just said, is not different from the spirits of wine prepared without an intermedium, except that it contains a small quantity of sulphate of soda in solution.

By calcined Acetate of Potash.

This method, proposed and lately employed by an able apothecary at Paris, succeeded beyond all hope; for the pure alcohol, distilled in a water-bath upon this salt, acquired more than 46 degrees, (the temperature of 10+0 of Reaumur,) but having examined this liquor, I soon perceived that it was no longer spirits of wine; and fearing I might be deceived, or have failed in the operation, I procured some of the alcohol from the author, prepared for the process indicated; on examining both, I easily perceived their similitude; they differ from good alcohol, 1st. by a pungent smell, which has some resemblance to the tincture of salt of tartar, used by the apothecaries; 2d. by a sour, soapy, and rather bitter taste; 3d. in rendering green the aqueous tincture of violet petals, &c.

It is therefore evident, that although alcohol obtained by this process has less specific gravity, yet the properties peculiar to this fluid are far removed from those of pure spirits of wine, and make quite a new kind.

From

From this short account, and the facts resulting from trials and experiments executed with care upon pure alcohol, of from 38 to 40 degrees, extracted from different sugary matters, which had undergone the vinous fermentation, it appears demonstrated to us, that the six saline substances before mentioned have all an action more or less direct, not only upon the last portions of the water which adhere rather strongly to the alcohol, but also upon the constituent parts of this fluid : whence it must be concluded, that none of these intermediums fulfil exactly the end proposed, by employing them to obtain a spirit of wine dephlegmated to the *maximum*, and preserving all the physical and chemical properties which it ought to possess in order to be reputed pure and commerciable.

It has also been proposed to substract the water from the alcohol at 36 degrees, by distilling it in a water-bath, with a weak dose of sulphuric acid, for example one-sixteenth of its weight. I have observed, that inasmuch as the spirits of wine does not exceed 38 degrees, it preserves by this rectification its characteristic properties; but if a fresh portion of acid is added to it, the product then acquires less specific gravity, and a fragrant odour, slightly ethereated, which announces that some degree of alteration has already taken place in the elementary principles of the spirituous fluid.

The ordinary alum of commerce calcined, considering the great quantity of humidity that it loses during its exposure to the fire, seemed also to be very suitable for taking away the superabundant water in the composition of the alcohol; in consequence, I added one part of it in powder to two parts of this liquor, marking 36 degrees. After two days, the whole was distilled in a water-bath, and the spirits of wine then gave 39 degrees.

It had rather an agreeable odour, but I was very much surprised at the new property it had acquired; it reddened rather strongly the aqueous tincture of turnsol and violet flowers. I rectified this alcohol three times with various proportions of calcined sulphate of alumine, and I constantly obtained only a liquor from 39 to 40 degrees; whence I conclude, that the alum deprived of its water of crystallisation seizes only on the foreign phlegm of the pure alcohol, without acting directly upon its constituent principles; but a small portion of this salt is also volatilised during the operations; and held in solution or in a state of extreme division by the spirituous fluid; for it not only reddens the blue vegetable colours, but it is also sensibly troubled by the water of barytes, effects which indicate the presence of alum.

I have also rectified alcohol to 39 degrees with muriate of grey soda calcined; we know that this salt retains about * of its weight of water of crystallisation; that a red heat only, and long continued, is capable of taking it away. It was in this state that I treated it with pure spirits of wine, hoping still to render the last-mentioned specifically lighter; but after several successive distillations and rectifications of these two substances in a water bath, the alcohol remained in its primitive state, and with its characteristic properties, which proves that the muriate of soda, even deprived of water, never acts to a very strong degree on the spirituous fluid; only like the sulphates of soda and alumine, a feeble portion of this salt is volatilised by the caloric and the alcohol during the operation; for this liquor sensibly whitens by the addition of a few drops of nitrate of mercury and silver; an effect which does not take place when the spirits of

* The fraction is omitted in the original.

wine

wine is very pure. It seems rather astonishing that fixed salts as alum, the sulphates and muriates of soda, should be volatilised during the distillation of the alcohol, and by such a moderate heat; but something analogous has already been remarked in N° 163 of the Annales de Chimie, by Messrs. Dabit and Ducommun at Nantes. They found some muriate of ammonia, carbonate, and sulphate of lime in the distilled water taken from a reservoir, where animal matters had formerly been. Kirwan and Lavoisier also affirm that nitrate of potash volatilises with boiling water. I have likewise many times collected the vapours which emanate during the confection of the alkaline salts, of the mineral kermes, sulphate of iron, acetate of lead prepared in the large way; and it has always been easy to me to discover traces of the metallic saline matters which form the base, and which explains to a certain point the volatilisation of the salts of which we have spoken, and their dissolution or their mixture in a state of extreme division with the alcohol after the distillation of these matters.

Reflecting on the hygrometrical properties of charcoal, and on the tendency of pure alumine, and ordinary clay, for the water which it retains in abundance, and at a degree of heat rather elevated, I have employed them successively for the dephlegmation of spirits of wine; and in consequence I have made many experiments, the principal of which I shall give in this place.

1st. *By charcoal.* To a litre of alcohol at 36 degrees *mean temperature,* I put four ounces, 128 grammes of charred birch-wood, well crushed and still warm; it was often agitated to facilitate the immersion and imbibition of the charcoal; after four days, I filtered it, and saw that the spirits of wine was still at 36 degrees. A similar

lar operation took place with very pure alcohol at 36 degrees; after several days of maceration on the charcoal, this spirits of wine likewise still preserved its original specific gravity. These effects tend to establish the fact that the charcoal equally absorbs the alcohol and water that it contains in superabundance.

The mixtures of charcoal and of spirituous liquor, were afterwards distilled to dryness, in a water bath; the alcohol which originally marked 36 degrees, rose one degree by this operation, but the latter retained its original specific gravity.

I repeated these trials, 1st, upon animal charcoal; 2d, upon the charcoal of different vegetables prepared from willow, oak, beach, &c.; but I never obtained the alcohol at other than from 39 to 40 degrees, even by operating upon considerable quantities, and by fractioning the products in order to establish areometrical points of comparison; which proves that the charcoal has no more affinity for pure water than for alcohol: only, as it has already been remarked, the alcohol, whatever be the substance that has produced it, acquires by its rectification on the charcoal, a sweeter odour and a more agreeable taste than that which is obtained in the ordinary manner, or without this intermedium.

TO BE CONCLUDED IN OUR NEXT.

Instructions on the Art of making Glue.

By M. Hermbstaedt.

From the Annales de Chimie.

GLUE is a gelatinous matter extracted by a particular process from various animal substances, and is afterwards dried in thin cakes of an oblong form. It is of great importance in numerous trades and manufactures.

The art of preparing glue may be reduced to eight principal operations. 1st. the choice of the animal matters; 2d. their purifications; 3d. their ebullition in water, in order to extract the gelatine; 4th. the clarification of the gelatine, while still liquid; 5th. its concentration until it acquires a thick consistence after becoming cold; 6th. the pouring it into moulds and dividing it into cakes; 7th. the drying of the cakes; 8th, and lastly, the bleaching of them. This last operation M. Hermbstaedt observes is not perfectly known in any of the manufactories of this article, although it is of the utmost importance.

Of the Matters employed in the Manufacture of Glue.

1st. All the waste parts of animals that contain much gelatine, may be used for making glue, with more or less success according to the quantity they produce. Among these the principal are: 1st. the feet of sheep and lambs; 2d. the head part, the tail and feet of tanned skins; 3. the waste pieces and clippings of the parchment-makers; 4th. the scrapings produced in dressing leather; 5th. the intestines of animals; 6th. raw and boiled bones; 7th. the fragments of ivory and of bone, which are the waste of workmen of those articles; 8th. the raspings of horn, the bristles of pigs, and the hair of all animals.

It

It must first be ascertained by experiments, whether the last-mentioned materials can be employed with advantage in the fabrication of glue. As for those mentioned in Nos. 1 to 5, M. Hermbstaedt remarks that when they proceed from old and lean animals, they produce glue of a better quality than what is obtained from young and flat ones.

Of the Purifications of the Matters employed.

2d. The different matters above described are usually charged with impurities and heterogeneous parts, which it is necessary to separate with care, in order to obtain glue of fine quality. It is sufficient for the feet of sheep and lambs, bones, fragments of ivory, the intestines of animals, &c. to be soaked and stirred in cold water, either river or spring, until the water runs from them perfectly clear; but the purification of the scraps of skins that come from the tanners and parchment-makers require more care, because they are not taken off until after the skins have been steeped in lime, which injures the quality of the glue. As these fragments of skin are usually dry and penetrated with calcareous particles, they must be softened in cold running water, in order to be afterwards crushed and pressed until the water extracts no more impurities; an operation which should be repeated several times with fresh water, in order to be certain that there is no lime remaining in the skin. They are afterwards spread upon gratings, hurdles, or nets, and left to dry in an airy place to be enabled to preserve them a longer time; or rather they convert them into glue while they are still moist. In this case they must be prevented from becoming putrid, which happens very speedily.

Of

Of the boiling of the Matters when purified.

3d. In order to extract by ebullition the gelatine contained in the waste from the skins and the feet of sheep, an iron or copper boiler is used, which is more deep than wide, and is placed in a stove, so that the flame may surround it up to half its heighth. This boiler, which is furnished with a wooden lid, that exactly fits it, must be kept always clean.

The sheeps feet are reduced to fragments about the size of one or two inches by means of a cleaver or hatchet, and the scraps of skin are softened in cold water: the whole is then thrown into the boilers, and stirred frequently with a wooden spatula, until the ebullition commences. The lid is then placed upon the boiler, and it continues boiling until the fibrous parts are dissolved. As it is rather difficult to determine exactly when all the gelatine is extracted from the feet, they are boiled a second time with fresh water, which must afterwards be employed in another operation.

Of the Clarification of the liquid Gelatine.

4th. After the whole is sufficiently boiled, the fire under the boiler is extinguished, and the liquor is passed through a hair seive, and is received into a very deep wooden tub, in order that the undissolved fibrous and boney parts may precipitate. The liquor is left at rest for some hours in this tub, which must be situated in a place moderately warm. The clarification is then effected and the heterogeneous matters precipitate; but the fat (particularly that from the sheep's feet and the bones) floats. In order to separate this, the liquid is drawn into another vessel by opening a cock fixed in the side of the tub, at about one-fourth of its height from the bottom. The cock is closed when the fat begins to come, and the liquor is thus obtained perfectly clear.

Of the Concentration of the clarified Gelatine.

5th. If the materials employed be very rich in gelatine, the clarified liquor will already have acquired such a consistency, that on exposing it to the cold, it will form a thick jelly; in this case it is useless to leave it to evaporate; but if on cooling it affords a jelly only clear and not elastic, it might be left to evaporate slowly in a boiler, to the requisite degree of concentration. However, as this evaporation injures the transparency of the glue, it is best to proportion the quantity of water and animal matter, so that at the first boiling, the liquid obtained, when exposed to the cold, is converted at once into a strong and elastic jelly.

Of the Formation of the Glue.

6th. The liquid gelatine while still warm is poured into a large square wooden vessel which is smooth inside, and having a moveable border twelve inches high, made so as to be easily put on and off. This vessel or case, of which the size is regulated according to the quantity of gelatine it is to receive, is usually from twelve to fourteen inches wide. When the gelatine is cold and is become a thick and elastic mass, the borders of the case are taken away and the glue is divided into cakes.

For this purpose an iron wire is used, the two ends of which are fixed to two handles, and is similar to that which is used in soap manufactories. With this instrument the glue is cut longways, in order to obtain a piece an inch thick, which is afterwards divided with a knife into pieces of six or eight inches wide, and which when dried become of the usual dimensions.

Of the Drying of the Glue.

7th. Long frames of wood furnished with nets are used for drying the glue: they are placed one above another

in

in an airy loft, and charged with the pieces of glue which are thus left to dry. But as it is of consequence that this dessication should be very quickly effected, it can only be attempted in the summer, because in winter, the still fresh glue easily spoils and becomes of a very deep brown; yet it must not be exposed to the immediate action of the sun, for in that case, instead of drying it would melt and fall through the net. In general the drying should be continued until the pieces will break neatly; and they are then strung in bundles.

The temperature of the air has a great influence on the colour of the glue; the quicker it is dried the more clear and transparent it is. In the opposite case, it attracts too great a quantity of oxygen from the atmosphere and becomes brown, which greatly diminishes its value, especially for the use of paper-makers.

Of the Bleaching of Glue.

8th. We have seen that what adds principally to the quality of glue, is its whiteness and transparency; that its deep colour and opacity is the consequence of a too slow dessication, often of negligence in the boiling, or of a defect in the proportions of the matters employed. The paper-makers require it very pure and colourless, because the brown always gives a yellowish tinge to the whitest paper. It is therefore of importance to destroy the colouring principle by bleaching, but as the glue that is dried in pieces, cannot be treated in this way, M. Hermbstaedt has contrived the following process for bleaching the gelatine liquid.

He first prepares some sulphureous acid, under a gaseous form; for this purpose he puts into a glass retort with a long neck, placed upon a sand bath, one pound of saw-dust, to which he adds one pound of concentrated

sulphuric acid, and lutes the neck of the retort after closing the orifice with a stopper, which is pierced in order to receive the shortest branch of a glass syphon, of which the other branch is immersed in a narrow cylindrical wooden tub containing the gelatine liquid.

By making a fire under the sand-bath, the sulphurous acid is converted into electrical vapour, which has a strong smell of sulphur, and which penetrating the gelatine completely destroys the colour. With a pound of saw-dust, and four pounds of sulphuric acid, a mass of gelatine may be bleached capable of furnishing an hundred pounds of dry glue.

The bleached gelatine contracts a sour taste, which it is necessary to destroy; and to this end M. Hermbstaedt advises, when four pounds of sulphuric acid are employed, to add to the mass one pound of pulverised oyster-shells, to mix the whole carefully, and to leave the liquor at rest until it no longer reddens the tincture of turnsol.

To favour the precipitation of the pulverised oyster-shells, and the clarification of the gelatine, it must be kept warm; but as soon as it is sufficiently clarified, it may be poured into the cases, and treated as before described.

Observations.

The scraps of skins submitted to ebullition give no liquid gelatine, but the sheeps' feet furnish a considerable quantity, that may be employed with much success to grease leather, or to burn.

It is best to boil the ivory and bones in a steam-boiler, or *Papin's Digester*, rather than in an ordinary boiler (which does not produce a heat sufficiently strong), and, by this means, the gelatine and the fat parts are more easily separated from the earthy parts.

Appli-

Application of the Heat (that escapes through Chimneys of the Boilers in large Establishments,) to a Ventilator and a Stove, which may be adapted to the Fabrication of Syrups, Sugar, Soap, and Indigo; to the Manufacture of sulphuric Acid, raw Soda, and Salt of Soda, of Alum, Potash, and Salt-petre, and all others where Liquids are evaporated, and the extracted Matter dried.

By M. C. PAJOT DES CHARMES.

(Concluded from Page 127.)

WHEN the liquids submitted to evaporation are not of an acid or corrosive nature, it may be more advantageous for the evaporator to be composed of cords, instead of twigs or slips of osier.

The cords may be twisted in the manner of basket work, so that they cannot become entangled by using, and they are useful in moderating the descent of the liquid, and keeping it longer exposed to the contact of the air attracted by the ventilator. Another advantage obtained by using the cords is, that they retain the liquid much longer than the osiers; they may also be made twice as long as the depth of the evaporating vessels, as their flexibility allows of the immersion of a greater surface in the liquid, which produces a more speedy evaporation in the same space of time.

In places where the boilers are too distant from the chimneys, or where the ventilator cannot be applied without extraordinary expense, nevertheless, the evaporator may be employed, for the surrounding air will have quite as much action on the surfaces of the osiers or cords, of whichever it is composed.

Being less limited in its play than when confined under a case or cover, the workman will probably be enabled to raise

raise the evaporator to a much greater height above the boilers, and thus to obtain a much longer space for the fall of the liquid.

We cannot fail therefore by this method, to obtain in the same time, all other circumstances being the same, both a stronger and quicker evaporation.

As the reduction of the solution advances, the network of the evaporator, whether it be composed of cords or osiers, retains the salt which does not dissolve in that solution, more and more concentrated. When the reduction is finished and the boilers are filled with a fresh liquid to be evaporated, the first immersion more or less prolonged, is sufficient to clear the evaporator of all the saline substances with which it may be encrusted.

§ V. *The Stove.*

The stove which I shall now describe, was executed with success at the glass manufactory at St. Gobain, and also at Soissons; it was especially intended for the dessication of the saline substances extracted from the reducing boilers. The disposition of the chamber where this stove was formed at Soissons, was such, that the boilers were situated precisely below it, which afforded the advantage of employing all the caloric in excess that proceeded from the fire-places.

In order to direct this caloric into the chamber of the stove, I establish several conductors for the heat, backed one against the other, and communicating with each other by their open extremities. A first conductor, forming a continuation to the flue of the chimney, of which the issue outwards was directed to the most convenient place by a register, received the caloric exhaled from the fire-places of the boilers, and communicated successively with the intermediate conductors unto the last,

last, which returned to the chimney above the register, and indicated the small proportion of caloric that was not absorbed.

The registers served to govern the temperature of the stove, which was judged proper to fix between 30 and 35° of Reaumur, from the experience, that at these degrees the saline substances, being previously well drained, do not fail to become completely dry, and the operation thus is rendered as little insalubrious as possible to the workmen employed.

Two apertures made in the cieling of the chamber may serve to correct this atmosphere. Or it can be easily modified or renewed by the total or partial opening of the windows and doors, or the different apertures made in the windows themselves, or in the partition of the wall opposite to them.

Although in this case the chamber of the stove is placed above the boilers, there is no objection to their being situated behind or at the side of them; in either case there are the same facilities, as the only difference is, that the conductors of the heat are horizontal instead of vertical; convenience alone must determine the situation of the stove, for when it is behind or at the side of the boilers it is not only more economical, because it requires only horizontal conductors, but also because the heat arrives sooner than when it comes through vertical conductors, and necessarily produces a more speedy effect. It is impossible to shew all the utility of a stove constructed upon the above principles; it depends upon different causes which may be more or less modified according to the nature of the establishment. I can only say that the advantage resulting from those at St. Gobain and Soissons was a saving in fuel equal to five thousand francs yearly.

The

The flues for conducting the heat may be constructed in several ways, either with bricks or with stone, no matter which, except the parts which give entrance to the heat, and which should in preference be composed of brick to the length of two or three feet. This precaution removes any fear of danger from the fire. As for the proportions of these conductors, they should not be more than a foot wide, by eighteen inches high. Those I had made at Soissons were according to these dimensions, and those at St. Gobain were only eight inches wide by twelve high. These proportions must be determined according to the bulk of the caloric that the conductors are to receive, the nature of the substances to be dried, the size of the place for the stove, &c. and also the sort of covering that is adopted for the conductors.

This covering, if the distance between the little walls of separation of the conductors is determined beyond the usual length of bricks or common tiles, is made of ridge tiles cut in their folds, or else of tiles or bricks made purposely, or with stone cut to suitable thickness. It is best likewise in all these cases to double the cover by a second row, the joints of which should cut those of the first; at the same time care should be taken that this double row be not made too thick, in order that the platform which they compose may receive sufficient heat to effect the proper desiccation of the substances placed immediately upon it, or that are otherwise disposed in the stove. This platform or covering, when composed of brick or stone, can only be employed, when a temperature of thirty degrees of Reaumur is sufficient, and when the substance intended to be dried on it would be injured by a contact with a platform of metal; whereas, on the other hand, when a high temperature is required, a plat-

a platform of cast-iron plates is to be preferred, to which may be communicated a heat as high as fifty and sixty degrees of Reaumur.

The stoves of this nature which I have caused to be constructed, were covered with cast-iron plates, and the joinings closed above with a flat iron band, coated with tempered clay, and on which were placed two plates, half the width, and brought as near to each other as possible. Thus no risk is incurred of any part of the substances that are spread upon the platform, running or falling between the joints.

If we consider the exterior disposition of these metal coverings, and that they are such good conductors of heat, their utility will be soon appreciated, as they may be applied to the dessication of an infinite number of substances. If we look also at the advantages to be derived from the internal disposition of the conductors, in the circulation and deposition of certain substances that have the property of sublimating and adhering to the sides of these sort of recipients, and which are more apt to condense by the insensible cooling produced from the degradation of heat in the conductors.

I have had occasion to use this apparatus in several experiments, especially for the fabrication of muriate of ammonia, sulphate of ammonia, &c. I shall presently give an account of the results.

I have shewn that in the cieling of the stove, two apertures were made for the air to escape that was more or less impregnated with the aqueous vapour of the substances to be dried; instead of losing the caloric with which this humid air is imbued, it would be possible to employ it for the service of any proper apparatus placed above or beside the stove; there are many cases in which a humid heat is necessary.

 Although

Although I have only described three methods of covering the conducting flues of the stove, namely, with brick, stone, or iron, it may sometimes be convenient, according to the nature of the substances to be dried, to have the covering composed, part of iron and part of brick or stone, which latter may be placed upon the iron. By this combination, a middle temperature may be obtained between that which is produced when the coverings are composed entirely of one or the other.

The registers and flues of the chimneys through which the heat is brought to the stove, should be disposed so as to give a free issue to heat out of the apparatus, by the direct channel of the chimneys of the fire-places of the boilers. This facility of introducing it within, or of carrying it out at pleasure, is of great utility in several cases.

It is also to be observed, that the passages made at the extremity of each conductor, should not be open quite so high as the little walls of separation, but only at the lower part, in such a manner that the sort of diaphragm with which this aperture is crowned, may for a long time retain the heat in the part of the flue which it successively fills. In order that the heat may be equally kept up in the whole space of the conductors, these conductors may be made to decrease in length from their opening into the flue of the chimney, to the extremity opposite to which they join; their width on the other hand may be increased from the square of the area of the chamber unto the covering.

If, instead of these conducting flues being established as above described, it is judged convenient to prolong them either horizontally or vertically, on the walls that surround the stove, before they are fastened again to the body of the chimney, it must necessarily augment the absorp-

absorption of the caloric in the apparatus, and contribute to exhaust it entirely; for this disposition of the flues placed on the walls round the chamber, tends to render that part which touches the cieling, always warmer than that near the floor. When the flues are thus prolonged, it is not only best that they should be horizontal, but also that there should be made a return to each, and diaphragms proper to retain the caloric in each conductor.

List of Patents for Inventions, &c.

(Continued from Page 128.)

Bazill Louis Mertian, of Threadneedle-street, in the City of London, Gentleman; for a Method of extracting or separating gelly or gelatinous matter from substances capable of affording the same, in order that the same may be used in the arts, or for domestic or other purposes. Communicated to him by a foreigner residing abroad. Dated July 12, 1814.

James Dawson, of York-street, in the City of Dublin, Esquire; for certain Means of producing or communicating motion in or unto bodies, either wholly or in part surrounded by water or air, or either of them, by the re-action of suitable apparatus upon the said water or air, or upon both of them. Dated July 16, 1814.

Joseph Smith, of the City of London, Plater; for a spring-hinge for doors and gates. Dated July 16, 1814.

Report of Arguments used on an Application for an Injunction against the "Tradesman's Magazine," for pirating various Articles from this Work.

THE Proprietor of this Work has long suffered from the piracies committed by different periodical publications, in publishing mutilated accounts of the Specifications of Patents which had previously appeared correctly in the Repertory; and also in occasionally copying from this Work, and publishing the Monthly List of Patents granted, and even the Translations made from Foreign Works; objects obtained at considerable expense and labour of selection. The practice was carried to such an indecent length by the "Tradesman's Magazine," that the Proprietor of the Repertory found it necessary to seek redress, by an application to the Court of Chancery for an injunction to restrain the Proprietors and Publishers of that Work from publishing or selling any of the numbers containing the piracies complained of; which being granted, the Proprietor of this Work hopes it will operate as a notice to others (who are following the steps of the "Tradesman,") to discontinue so unfair a practice, or they will be visited by similar proceedings.

The following is a correct Report of the Arguments on the Motion for an Injunction:

COURT OF CHANCERY, Lincoln's-Inn, July 20, 1814.

Wyatt, *v.* Barnard and others.

Sir Samuel Romilly moved for an injunction to restrain the Defendants from selling any numbers of the "Tradesman, or Commercial Magazine," for the months of January, February, March, April, May, and June in the present year, as several parts of them were pirated from the

the Work of the Plaintiff, the "Repertory of Arts, Manufactures, and Agriculture." The Plaintiff's work contained Specifications of Patent Inventions, Lists of Patents granted monthly, Selections from English and Translations from Foreign Works relating to Arts and Manufactures. The Defendants had in numerous instances copied them *verbatim*, even to their very errors; they had also copied abridgements from English Authors, which were abridged by the Plaintiff, and appeared in his work. He understood their defence was, that the Plaintiff having published them, all the world had a right to copy them. He allowed that two persons might translate the same article, but it was impossible that these translations would be word for word the same. Under these considerations he trusted his Lordship would grant the injunction.

Mr. Johnson followed on the same side, he thought this was a clear case; the Defendants by their affidavit had admitted that they had copied the articles in question from Plaintiff's Work. His Lordship had repeatedly granted an injunction in similar instances; and particularly in a recent case, that of Longman *v.* Winchester, in which his Lordship decided that there might be copy right in a Court Kalendar, because, although it was a mere compilation, no one shall take the benefit of the compiler's labour *. Mr. Johnson concluded, therefore, that

* In Longman *v.* Winchester, (16 Ves. 269,) the Lord Chancellor, in giving judgement in that case, expressed himself as follows:— "Take the instance of a map describing a particular county, and a map of the same county afterwards published by another person: if the description be accurate in both, they must be pretty much the same; but it is clear the latter publisher cannot on that account be justified in sparing himself the labour and expense of actual survey, by copying the map previously published by another. So, as to Paterson's Road Book, it is certainly competent to any other person

that as this case stands upon precisely the same basis as those cited, his Lordship could not refuse the Injunction.

Mr. Leach, Counsel for the Defendants, stated, that the fact was acknowledged, that the Translations were taken from the Plaintiff's Work; both publications were compilations, and it was in those kind of cases the custom of the trade to copy one from the other.

Lord Chancellor.—"That may be Bookmakers' law, but certainly it is not the law of the land."

Mr. Leach in continuation contended, that a Court of Equity ought not to interfere, although he admitted it was not law. He was sure his Lordship would not put persons of this description to the expense of translation, when the thing was already translated, and a matter of great convenience. It was not an answer in law, but he trusted it would be in equity.

son to publish a Book of Roads, and if the same skill, intelligence, and diligence, are applied in the second instance, the public would receive nearly the same information from both works; and there is no doubt but that this Court would interpose to prevent a mere re-publication of a work, which the labour and skill of another person had supplied to the world. So in the instaance mentioned by Sir S. Romilly, a work consisting of a selection from various authors. Two men perhaps might make the same selection; but that must be by resorting to the original author, not by taking advantage of the selection already made by another. In the case of Hogg *v.* Kirby' there was no doubt that any person might publish a work of the description which was the subject of that injunction. Each party might publish his own collection, and the articles might happen to be the same; but the one could not excite the public curiosity, *by copying into his work from that of the other.*" His Lordship continued, The question before me is, whether it is not perfectly clear, that in a vast proportion of the work of these Defendants no other labour has been applied than that of copying the Plaintiff's work. From the identity of the inaccuracies, it is impossible to deny that the one was copied from the other *verbatim et literatim.*"

Mr.

Mr. Heyes followed on the same side, and said, that the Defendant first formed the plan of introducing Translations into his Work in the year 1813, at which time the Plaintiff had no such articles*. The contents of the Plaintiff's Work were compiled from other works. He would ask how a man acquired a copy-right in what he had copied himself? The Defendants might have taken it from the same books themselves. This argument he meant only to apply to English Authors. As to the Translations from the Foreign Authors, it was sworn that all periodical publications were in the habit of copying one from the other. The Authors from whose works they were translated were now living, and would have as great a right to come before his Lordship, and ask an injunction against the Plaintiff.

Sir Samuel Romilly stated in reply, that they were original Translations, and as such were the property of the Plaintiff. He could not see the difference between a translation from a dead and a living Author. It was surprising that the Defendants should assert that Plaintiff had only recently inserted such Translations: he held in his hand the first volume of the Plaintiff's Work, of which they formed part of the plan; this was published upwards of twenty years ago, and the continuance of the Work sufficiently shewed the estimation in which it was held by the Public. As to the Specifications of the Patents which the Defendants had copied, if they had gone to the Patent-office and paid the Clerks for the copies of them, they certainly would be entitled to publish them; but they had no right to take advantage of the expense, the labour, and the skill of selection which the Plaintiff

* Translated Papers have never ceased to form a conspicuous part of this Work.

had

had employed for this purpose. There were many articles which the Plaintiff had abridged from English Authors, which the Defendants had copied; he could not point out the specific passages, but he would get his Client to make an affidavit of what they were, when he trusted his Lordship could have no doubt as to granting the injunction.

The Lord Chancellor observed, that he would wish Sir S. Romilly would have the affidavit made. The Court was always unwilling to grant injunctions as to part of a publication, without the fullest evidence, as it generally stopped the sale of the whole book; but if a person mixed bad company with good, the latter must be liable for the sins of the former. He would at present grant the Injunction against the translations, at the same time enjoining the Plaintiff to bring his Action forthwith in a Court of Law.

July 25th.

Sir S. Romilly stated, that the Plaintiff had made the affidavit required by his Lordship; and he therefore trusted that he would grant the Injunction prayed for.

The Lord Chancellor,—" Take the Injunction; and, as I suppose the Plaintiff will bring his Action at Law, the Defendants may be at liberty to apply to the Court after the trial."

Mr. Leach,—I shall not advise my Clients to defend the Action; I imagine there can be no question as to the Law.

Injunction granted.

THE

REPERTORY

OF

ARTS, MANUFACTURES,

AND

AGRICULTURE.

No. CXLVIII. SECOND SERIES. Sept. 1814.

Specification of the Patent granted to John Ruthven, *of Edinburgh, Printer; for a Machine, or Press, for printing from Types, Blocks, or other Surfaces.*

Dated November 1, 1813.

With a Plate.

To all to whom these presents shall come, &c. Now know ye, that in compliance with the said proviso, I the said John Ruthven do hereby declare that the nature of my said invention, and in what manner the same is to be performed, are particularly described and ascertained in manner following; that is to say: My printing press differs from those heretofore used in the following particulars. 1st. The types, plates, blocks, or other surfaces from which the impression is to be taken, instead of being situated upon a running carriage, as heretofore practised in printing presses, are placed upon a stationary platform or tablet, which is provided with the usual apparatus known to printers by the names of tympan and frisket, with points, &c. to receive the sheet of paper, and convey it to its proper situation on the

types, after they have been inked. 2d. The machinery by which the power for the pressure is produced is situated immediately beneath this platform or tablet; and the platen or surface which is opposed to the face of the types, to press the sheet of paper against them, can be brought over the types, and connected at two opposite sides or ends with the machinery beneath the tablet: by this machinery it is so forcibly pressed or drawn down upon the paper, which lays upon the types, as to give the impression; which being thus made, the platen can be disunited from the machinery, and removed from off the types by the foot, or otherwise, to take out the paper, and introduce a fresh sheet. 3d. The said machinery for producing the pressure is a combination of levers, actuated by a crank, or short lever, turned by a winch, or handle, to which the pressman applies his hand; or the pressure may be produced by the tread of the foot.

These particulars of my invention admit of various forms, or modes of construction; but those which I have found by experience to be most applicable and convenient for practice are described by the drawings hereunto annexed; in which Fig. 1 (Plate IX.) is a horizontal plan of a printing press; Fig. 2 a vertical section, taken through the middle; and Fig. 3 an end view: the same letters of reference being used in every one. A A represent the tablet or surface upon which the types, &c. are laid; its surface truly flat, and may be made of wood, stone, or metal, or any other substance used for the carriage of printing presses; but I commonly have it made of cast-iron. This tablet is mounted upon a frame of wood, or metal, consisting of legs, B B, and cross braces, C C; or any other kind of support may be used which will firmly sustain the tablet at a proper height from the ground. The tablet has the tympan 8 and 9 jointed to it

at

at the end 9, in the usual manner, and open into the position of the dotted lines 10, to take off or put on the sheet of paper, which is confined by the frisket 11, in the usual manner: the dotted lines 12 represent the gallows or support for the tympan and frisket when opened.

For fastening the types upon the tablet, or what the printers call making *register*, quoins or wedges may be introduced at the angles, in the usual manner; but a method which I prefer is to have screws, 13 13, fitted through pieces, which are made fast to the sides of the tablet; and between the points of these screws the chase, or frame of types, is held steady upon the tablet, and may be adjusted. Beneath the tablet are the levers marked DE DE, their fulcrums, or fixed centre pins, being at D, and they act upon double hooks, or clutches, F F. When the ends E are depressed by means of the third lever I G, situated beneath and common to both, the connection being made by the link *a*, the fulcrum of the lever is at G; and H is a third point to which the power to actuate it is applied by a connecting rod K, the opposite end of which is jointed to a crank or short lever L M, situated upon an axis or spindle L, which extends to the front of the machine, and has a winch or handle N, Fig. 1, upon it for the pressman to turn it by. The platen of the press is shewn at O O: it may be made of wood or iron, as usual, but must be exactly true on the lower surface, which applies to the face of types *b b*, upon the tablet A A. On the top of the platen is a strong metal bar P, which may be either cast in one piece with it, or united to it by screws, at *r r*: at its extremities it has bolts, *d d*, fixed to it by screws, or otherwise; and at their lower ends they have heads, which are exactly fitted to the clutches, or double hooks, F F, before described. By means of these the platen is connected with

the lever DE DE, so that a pressure may be produced when the handle N is turned in the direction shewn by the arrow in Fig. 2. This, by turning the lever M about upon its centre L, pushes the rod K, which, acting upon the point H of the lever G H I, moves it upon its centre G, and depresses the point I, which being connected with the extremities E of the levers D E, by the link *a*, they are made to partake of its motion, and draw down the platen upon the types by the clutches F F and hooks *d d*. By returning the winch N to its original position the pressure is relieved, and the platen may be removed from the types thus: at the ends of the bar P two springs, *e e*, Figs. 1 and 3, are fixed; and in the ends of these, rollers or wheels marked *f*, are fitted, to revolve freely upon their centre pins. These wheels, having grooves in their edges, run upon sharp angles, formed upon the upper edge of two rails R R, which are extended across the frame of the press, and project sufficiently behind, as in Figs. 1 and 3. being supported by brackets *g*, of Fig. 3, if necessary. Upon these bars and wheels (or sliders may be used in lieu of wheels) the platen will run freely, to remove it backwards off the types, but when brought over them the bolts *d d* will enter the clutches F F, ready to receive the action of the levers, and give the pressure upon the tympan. The springs *e* are so adjusted, that when the platen runs backwards or forwards upon the rails R, the under surface of it will be sufficiently raised above the tympan to run clear of it; but when the hooks *d d* and F F are united, and the pressure given by turning the handle N, these springs yield, though they have sufficient strength to raise up the platen clear of the tympan the instant the pressure is relieved. To draw the platen forward over the types a handle *h* is fixed upon it, for the pressman to take hold by; but it may be brought

brought forward by the foot in the following manner: the two foremost wheels *f f* have links *k k*, jointed to their centre pins, to connect them with the upper ends of two long levers *m m*, which are affixed to one common axis *n*, Fig. 2, extending across the whole machine, near the ground; upon the axis a short lever *o*, Fig. 3, is fixed, and a rod *q* unites it to the end of bent lever *r i*, the arm *i* of which is made broad, to serve as a paddle for the foot; by depressing this the arm *r* draws the short lever *o*, and the long lever *m m* causes the platen to advance truly parallel, and come up to the clutches F F.

To make all the work compact, the centres D D of the great levers, and of the lower lever G, as well as the pivots L of the winch N, are all supported in one frame, composed of two metal cheeks S S, which are situated beneath the table, and united thereto by screws, or otherwise, as shewn by the dotted lines in the plan Fig. 1.

The power of the press will depend upon the proportions of the different levers, and the relation between the space described by the motion of the handle N and the descent of the platen O; but it should be observed, that the power of this press increases as the handle descends to the horizontal position shewn in Fig. 2: *first*, because the handle is then in the most favourable position to receive the workman's body; *second*, the lever L M comes to a position which gives it great power to force the rod K, *viz.* as is shewn by the dotted line L 2; for when the lever and rod come to one straight line, its power to force the rod K may be considered as infinitely great; *third*, the lever G H is in the most favourable position, marked G 2, to receive the action of the rod K, *viz.* perpendicular to it; *fourth*, the lever G I is in a position to have greater power on the links *a* and the levers D E than when

when it is in a horizontal position. All these sources combined have the best effect in saving time, and at the same time producing an immense pressure; for when the pressman first takes hold of the handle N it acts but with little advantage in respect to power upon the levers, and therefore brings the platen down very quickly upon the tympans, with little loss of time or motion, till they have assumed positions, in which they exert more powerful action upon each other, as above stated; and this action continues to increase until the lever L M and rod K come nearly into a line, when the power is immensely great, and capable of producing any required pressure which the parts of the press will withstand without yielding. The handle N is made to come to a stop, or rest, which prevents its moving farther than the position of the dotted lines, and therefore regulates the degree of pressure given upon the work. But to give the means of increasing or diminishing the pressure at pleasure for different kinds of work, the centre hole of the pin H is made in a piece, which is fitted in a groove in the rod K; therefore by sliding it in the groove, and fitting packing in the groove, it has the same effect as lengthening the rod, which produces a greater descent of the platen when the handle is brought to its stop: a screw, *s*, is fitted into the end of the groove, to screw the packing tight in the groove, and prevent it getting loose in the working.

Another method of producing the same effect is to adjust the nuts which are fitted on the screws at the top of the bolts *d d*; or it may be done by loosening the screws at *r*, and fitting packing between the fitting of the platen and the bar P: the same may be done to adjust the platen parallel, if it prints more at one part than another.

Springs may be applied to take off all shake or looseness in the joints; it may be done in different ways: a strong

strong spring may be fixed beneath the tablet, and act upon the clutch F, to lift it up, and keep the joint tight; or one small spring may be fixed on the lever D E, (as shewn at the opposite side,) to lift up the clutch F, and another being fixed to the lever beneath, and resting at the end upon a pin in the frame, will lift up the lever and link *a*, to keep them all tight for working. If it is thought objectionable for the rod K to push endways on the levers, it may be contrived to draw or pull, by placing the lever M above the spindle L instead of beneath it, and also reversing the form of the lever G H I; the points G and H to remain as they are, but the point I to be on the opposite side of the centre, *viz.* above it; and with this alteration the drawing of the rod K will produce the pressure, instead of pushing it, as in the figure.

Fig. 4 shews another arrangement of the levers for a press. In this figure the same letters are used to denote the same parts, thus: A is the tablet, D E the levers, F the clutches, O the platen, P the cross bar; the ends E of the levers are connected by the link *a* with a third lever T W, whose centre or fulcrum is at V; the power is applied to the long end by a chain *t*, which is conducted over a pulley or roller *v*, and wound upon a wheel *w*, which is fixed upon the axle of the handle to work the press. To give greater power the wheel may be formed like a spiral instead of circular, that the chain may lay upon a shorter radius when the pressure is produced.

In witness whereof, &c.

Observations communicated by the Patentee.

After perusing the accompanying voluminous Specification it may be supposed enough on the subject; though at the same time it must be admitted not of a nature to be

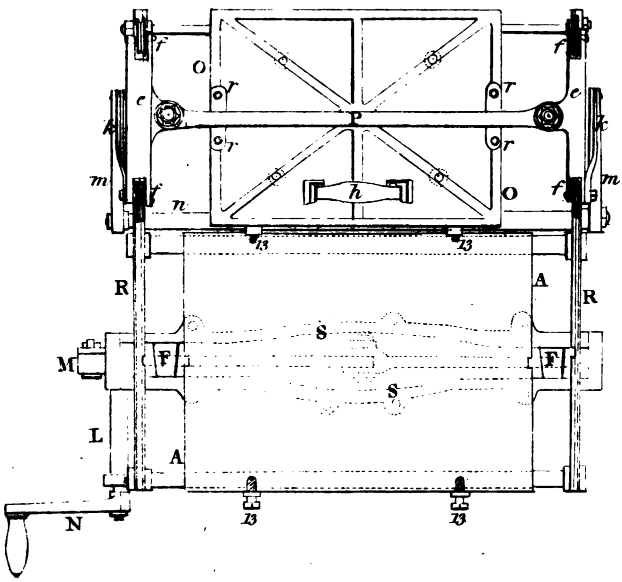
be readily conceived or understood. I shall here refer to the three first heads in the Specification, and then briefly state the object I have had in view in bringing forward such an invention, that a kind of general idea may be formed of it. Having studied the printing business practically for upwards of twenty years, I was naturally led to examine the construction of the printing press; the labour to the workmen I considered excessive, and the press in many cases not adapted for the work. To remove these objections, by endeavouring to improve it, I did not think practicable, and I determined to attempt one on a new construction; the following is therefore what I conceive to be the result: the labour reduced; more expeditious; capable of doing every kind of work with accuracy, by means of a regulator for producing different degrees of pressure; a correct method of making register; not occupying so much space, &c. &c. The principles of the construction are also equally applicable to presses down to the size of a press not occupying more space than a cubic foot, and though made wholly of iron is easily carried under the arm, and throws off impressions from an octavo page with great facility.

As practice may be denominated the proof of theory, to that I now submit it, and to the decision of those for whom I have brought it forward. In order to secure it as much as possible from the danger of being manufactured in an inferior manner, I have consigned the making of the presses for England to Mr. Keir, Engineer, St. Pancras, whose abilities are well known to printers.

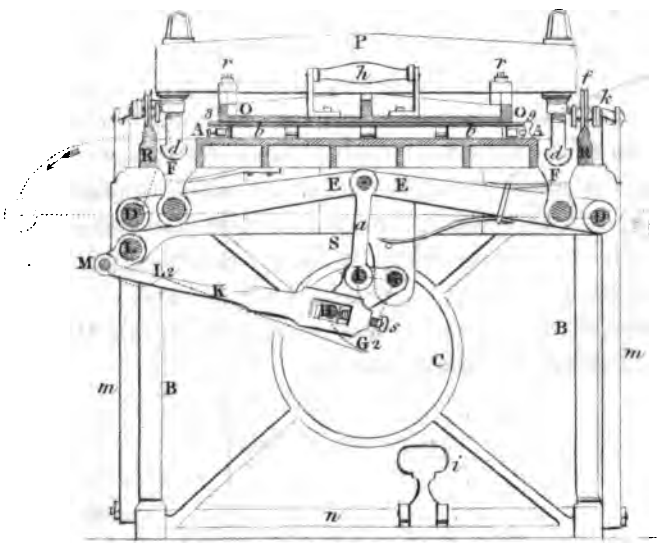
One of the presses is now at work at Messrs. Haines and Turners, 75, Margaret-street.

Specification

Plan. Fig 1.



Section. Fig. 2.



Specification of the Patent granted to JOSEPH PRICE, *of Gateshead, in the County of Durham, Glass-maker; for several new Methods of making Glass.*

Dated May 5, 1814.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said Joseph Price do hereby declare that the nature of my said invention, and the manner in which the same is to be performed, is as follows; that is to say: The object of my invention is to make glass that, without grinding, shall answer all the purposes of ground glass, by transmitting the light through it in that soft and agreeable manner similar to ground glass; and I effect this by the following means, *viz.* I prepare a pot of flint glass and a pot of white enamel glass, in the respective proportions after mentioned, and when brought into fusion in the usual way, at a proper temperature for working, I gather or take, in the usual way, with a gathering pipe, from the enamel pot, a quantity of metal, proportioned to the article intended to be manufactured, and cover it with metal gathered or taken in like manner from the flint glass pot, and proceed to blow and form them to the shape of the article required. The enamel will then be pretty equally spread throughout the inside of the said article, and have rendered it nearly of an opake white, resembling in appearance, and possessing an effect, though more agreeable, similar to that of ground glass in the transmission of light. Practice and experience only can direct the relative proportions of the enamel and flint glass to be used; it will suffice to say, that the quantity of enamel must be sufficient to give the article a white opake appearance, but not so much as to

prevent in any material degree the transmission of light through it. The enamel must be of a flake white, otherwise the desired effect will not be perfectly produced, and the flint glass and enamel must be (as termed by the workmen) of the same temper, so as to unite or combine with each other.

The effect may also be produced by the following method, *viz.* Gather or take on a gathering pipe a portion of flint glass, and cover it with enamel, and then cover the enamel with flint; then blow and form them to the shape required, as before directed: the enamel will then be spread between the bodies of flint glass.

The two foregoing methods I recommend as best adapted to produce the effect before specified: but it may also be produced, though not in such perfection, by another method, *viz.* by gathering, as before, a portion of flint glass, and covering it with enamel, and then blowing and forming them as before; the enamel will then be spread on the outside of the article. A degree of opacity may be given to glass by any of the following materials, as substitutes for arsenic, that is to say, calcined tin, commonly called putty, calcined antimony, or calcined bones, or ivory, but not in such perfection as by the enamel before mentioned; I do not, therefore, recommend this latter mode of producing the effect.

In order to make flint glass and enamel of the same temper, or so as they will unite or combine with each other, I charge two pots, one for flint glass and one for enamel. The following materials and proportions are for the flint glass, *viz.* of Lynn sand, or any other sand having similar chemical properties, or calcined flints, in powder, four hundred and twenty pounds; litharge, or lead, two hundred and eighty pounds; pearl ashes, one hundred and forty-seven pounds; nitre, fourteen pounds;

cullet,

cullet, or broken flint glass, three hundred and thirty-six pounds; manganese, three quarters of a pound. For enamel: of sand, as before, or calcined flints, one hundred and twelve pounds; litharge, or lead, one hundred and twelve pounds; nitre, fifty-six pounds; arsenic, twenty-five pounds; cullet, or broken flint glass, one hundred pounds.

N. B. The proportions of the materials may be varied according to their strength in both pots, provided the relative qualities of each pot are maintained so as to agree and unite with each other. The cullet, or broken flint glass may be omitted; but in that case the proportions of the other materials must be varied as the temper of the metal may require. The means of varying the proportions of the other materials are known to all experienced manufacturers.

In witness whereof, &c.

Specification of the Patent granted to THOMAS WRIGHT, *of Great Saint Helens, in the City of London, Broker; for a Method of making a Composition or Mixture for dying Scarlet and other Colours.*

Dated December 9, 1813.

TO all to whom these presents shall come, &c. Now KNOW YE, that I the said Thomas Wright, in compliance with the said proviso, do hereby declare that my said invention, and the manner in which the same is to be prepared, is described in manner following; that is to say; One hundred pounds of the composition is composed of about twenty-six parts lac, lake, or lac dye, about forty parts lac spirits, or solution of tin, about

twenty-six parts cream tartar, or argol, about one part turmeric, about two parts cochineal, about four parts extract of safflower, and about one part diluted sulphuric acid; one pound whereof I use to dye two pounds weight of cloth, yarn, or stuff, a brilliant scarlet.

For purple, violet, lilac, and such like colours, to which cochineal is applicable, add to a solution, of about four ounces of indigo for one pound weight of cloth, from half an ounce to six ounces of the composition, according to the depth of colour or shade required. The quantity of indigo should also be varied in proportion for the solution.

In witness whereof, &c.

Remarks and Emendations on a Translation of a Paper on the Art of making Glue, by M. Hermbstaedt, *inserted in the last Number of this Work. By* THOMAS GILL, *Esq. St. James's-street, one of the Chairmen of the Committee of Mechanics of the Society for the Encouragement of Arts, Manufactures, and Commerce, of London.*

Communicated in a Letter to the Editors.

GENTLEMEN,

I TAKE the liberty of sending some remarks and emendations on a translation of a very valuable paper on the art of making glue, by M. Hermbstaedt, in your Repertory for this month, from the Annales de Chimie, *viz.*

Page 175, in enumerating the principal operations, the eighth speaks of bleaching the *cakes of glue*, which, however, under that head, in page 179, is said not to be the case; but is applicable only to the *gelatine liquid.*

In the same page, 175, in the enumeration of the matters employed in the manufacture of glue, the second mentions

mentions the head, tail, and feet parts of *tanned* skins; which, however, in the next page, under the head of the purification of the matters employed, prove to be *untanned*; having been merely steeped in lime, to take off the hair, and requiring therefore to be cleaned in running water, as there directed, to free them from the lime; and I am doubtful, whether those named in the fourth class, *viz.* the scrapings produced in dressing leather, can be employed without the aid of another process, not described, but which I shall mention in the sequel of this communication.

Page 180, line 8, *electrical** I presume should be *elastic*: and in line 28, the word *gelatine** I also presume should be *fat*.

The process I alluded to, for preparing glue from *tanned* skins, is employed by the black or brown paper case-makers; and, as I have never seen it published, I apprehend it will prove acceptable to many of your readers: it consists in boiling scraps of such leather as the upper leathers of boots and shoes are made of, in stale urine, until they become soft and pliant, and capable of being stretched out considerably; when they must be well washed, to free them from the urine, and again boiled in a proper quantity of water, to form a glue of a fit consistence for use. This glue has a property which excellently adapts it to their purpose, namely, of becoming black, in consequence of the gallic acid contained in it, when the paper articles made with it are wiped over with a solution of sulphate of iron.

Besides the use of glue as size, employed by paper-makers, as stated in page 179, it is also used as size by the paper-hanging-manufacturers, and they prepare a

* The translation of these words was correct.

very

of the two cutters C D; the cutter C is made rather longer than D, and is formed into two sharp cutting edges, and prevents the wood from splitting up, and making an uneven hole, by cutting two parallel lines round the circle, for the other cutter D, to follow in, and take out the wood between the lines.

Fig. 1.

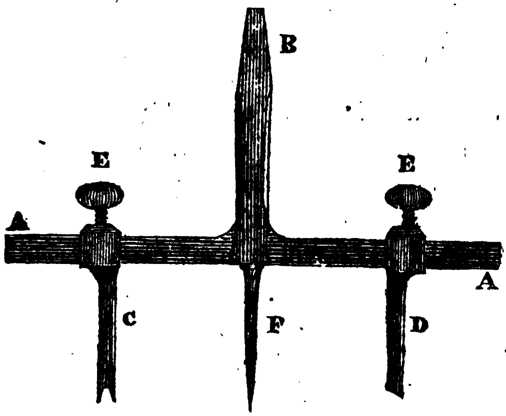


Fig. 2.

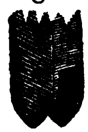
The form of these cutting edges, is shewn on a larger scale in Figs. 3 and 4, the latter shewing the two sharp scribing edges to cut the sides of the circular groove; and the other, the sharp hooked edge, which cuts up the wood from between them, in the manner of a chissel.

Fig. 2 shews the construction recommended for smaller expanding centre-bits, the shank A is swelled out at its lower part into a square D, large enough to have a mortise through it for the reception of two arms, which are bent down at right angles at the ends, and form the two cutters B C; these arms lie beside each other in the mortise, and can be removed from the centre both ways, to the size of the intended hole, both being bound fast in the mortise by the screw D; the centre-pin E, and the two

two cutting edges, are like those shewn on a larger scale at Figs. 3 and 4; the one, Fig. 4, coming first into contact with the board to be perforated, makes two deep lines in it, parallel to each other, and of the same distance apart as the width of the opposite cutter, which is shewn at Fig. 3, and has a sharp edge formed on a surface rather prominent, so as to cut the wood out between the lines made by the first cutter.

Fig. 3.

Fig. 4.



The middle point E is made pointed and sharp, in order not to impede the action of the cutters when in use.

Description of Elevators or Machines by which Persons can be raised up to a great Height; and which Machines may be employed as Fire-Escapes, Observatories, or for Repairs of Buildings.

By Mr. THOMAS ROBERTS, *of Wardour-street, Soho.*

With Two Plates.

From the TRANSACTIONS of the SOCIETY for the Encouragement of ARTS, MANUFACTURES, and COMMERCE.

The Silver Medal and Twenty-five Guineas was voted to Mr. ROBERTS *for this Invention.*

HEREWITH I send a model of an invention for the consideration of the Society of Arts.

I constructed this model with the view of its being rendered serviceable in the event of a siege. I thought it might also be applied for the purpose of an escalade, as

as it might be used and removed with ease from place to place, as might be required.

It may also be used as an observatory, or to assist persons in cases of fire, or on many other occasions.

Attached to the landing there is a bridge, which will easily be placed in a direction so as to communicate with a wall or window.

The Drawing sent with the model is intended to shew a more simple and cheaper method of effecting the same purposes, and may be raised with equal facility by one screw instead of four which are employed in the model.

The whole machine, when raised to its greatest height, will be above four times the height of the box in which it is contained when lowered, and in which it can be inclosed and conveyed, by means of the four wheels underneath, from place to place, as occasion may require.

Reference to Plate X.

This machine consists of a very ingenious combination of levers, or bars, which, when out of use, shut down close into a chest, or case, mounted upon four wheels, for convenience of moving it from place to place, in the same manner as a fire-engine. By turning a handle, or winch, the levers are caused to rise out of the box, forming a lofty pyramid, as shewn in the figure, which, having ladders within it, makes a convenient scaffold and staircase, by which any person can ascend to a platform situated on the top, to assist others in escaping from a house when on fire, or for many other purposes, to which this machine may usefully be applied.

The levers are forty in number, and are arranged in four sets, forming the four sides of the frame or pyramid; as the levers of all these four sides are connected together

ther in the same manner, the letters of reference are only marked upon one side, which is the front, to avoid the confusion of such a number of letters. The ten levers belonging to this front side are marked 1, 2, 3, 4, 5, 6, 7, 8, 9, and 10: they are jointed together in pairs, by centre pins passing through the middle of each; thus the pairs 1 and 2, 3 and 4, 5 and 6, 7 and 8, 9 and 10, are united together by their respective centres, so as to open and shut, in the manner of a pair of shears: these pairs are again united together at their ends, 2 and 3, 4 and 5, 6 and 7, 8 and 9, 1 and 4, 6 and 8, 5 and 8, 7 and 10. The consequence of this arrangement is, that by bringing the lower ends 1 and 2, of the first pair of levers together, the upper ends 1 2 are also made to approach each other, and carrying with them the lower ends of the second pair 3 4, causes them to shut towards each other. These operate upon the next pair, and so on up to the top. Thus the ends of the whole system of levers are caused to approach each other at the same time, which, by bringing all of them nearer to the vertical position, increases the height of the pyramid to almost any required extent until they are exactly vertical. It is upon this principle that the frame is made to rise up to elevate the scaffold A, which it bears upon its top to a sufficient height to reach the upper window of a house, &c. The centre pins, which unite the extremities of the levers together, are screwed into blocks of wood *b b*; and the centre pins of the levers, forming the other side of the frame, being fixed into the same blocks, the different sides of the pyramid are united together, as the figure shews too plain to require any other reference. The scaffold or platform A, at the top of the machine, is supported from the centre pins connecting the upper pair of levers 9 and 10. These pins have, within-side the frame,

horizontal rails *m* attached to them: at the extremity of these are jointed rods *c c*, which, at the upper ends, are connected by the joints to the four angles of the platform A, so as to carry it up horizontally when the frame is elevated. A hand-rail, *a a*, surrounds the edge of the platform, at a proper height, to prevent persons falling over. An apparatus is also erected upon this platform, to form an horizontal communication with the window of a house, &c. when the machine is placed at some distance from it: it consists of two ladders *e e*, placed at a small distance asunder, and parallel to each other, being united by a number of bars, extending from one to the other, and connected to them by joints. Both ladders move at their lower ends, upon a centre pin, which is fixed to the platform, so that they can incline either way at pleasure; to the top of these two a third ladder, B, is jointed, in the same manner as the horizontal rails which connect the two together. This communicates with the window of the house, and may be made to reach out to any moderate distance, by inclining the two ladders *e e* on their centres; and in all positions it will retain its horizontal position, so that a person can safely walk along upon it from the window of the house, and descend by the ladder *e e* to the platform; and thence, by means of the ladder *ff*, situated in the inside of the machine, to the ground. These ladders are extended from pieces of wood fixed to the joints or centre pins of the respective levers, so that in all positions of the frame they form a continued staircase or ascent from one ladder to the next; the inclination of the ladder altering in the same degree as the levers of the frame, to which they always remain parallel. The whole machine is, as before mentioned, mounted on the four wheels F F F F, and is drawn by shafts, connected to the pieces G, which project from the axletree

of

of the fore-wheels in the same manner as a fire-engine or other four-wheeled carriage.

The lower ends 1 and 2, of the first four pair of levers, are caused to approach each other for the purpose of elevating the pyramid, by means of four large screws D D, at the bottom of the machine. They have pivots at the ends, which are received into pieces of wood fixed to the floor of the carriage E E, on which the machine is erected, so as to turn round freely; and they operate upon female screws within the pieces of wood *h*, to which the lower ends 1 2 of the levers are jointed: these pieces of wood have also rollers running upon the floor of the carriage, to diminish the friction of advancing the ends of the levers together, when the machine is to be elevated, which would otherwise be very great, as these rollers support the whole weight of the superstructure. The four screws D radiate at right angles from the centre of the machine, and have toothed-wheels fixed upon the inner end of them, which are actuated by a horizontal crown-wheel *m*, common to them all, and situated in the centre of the machine, within a square frame, formed by the four pieces of wood, which bear the pivots of the screws D D. Now, it is evident, that by turning this central wheel, the four screws will all be put in motion uniformly together, and operating upon the pieces of wood *h h*, will cause them all to approach or recede from the centre together; and, carrying the ends 1 2 of the levers with them, the frame is made to rise up out of, or descend into, the chest at pleasure.

The central wheel *n* is fixed upon an upright spindle, which has another crown-wheel fixed upon it beneath the floor of the carriage; and this is turned by a small pinion fixed upon an axis, proceeding to the side of the carriage, where the winch H is applied to the end of it; this being

being turned round by a man, turns the wheel *n* with a considerable power, and elevates the frame. The ladder marked *g*, within side the machine, at the lower part, shews how a second set of ladders may be applied, so as to make two complete staircases from the bottom of the machine to the top, but only one set of the ladders is shewn, to prevent confusion. The lower end of this ladder, as well as that marked *f*, is supported by a rod, jointed to it, and extending to a joint at the top of the square frame in the centre of the machine.

The model deposited in the Society's collection contains also a very ingenious contrivance for preserving all the steps of the ladders horizontal, let their elevation be what it may. This cannot be shewn in the Plate, but may ready be comprehended without a separate figure. The steps of the ladders are fitted to the sides or cheeks by two centre pins instead of fixed tenons, and have each a tail, projecting in the middle of their back or under sides. These tails are all connected together by a rail or bar, which has slits or mortices through it to receive those tails, and holes are made both through the sides of the mortices and through the tails which receive pins, upon which the tail turn. By this means all the steps of the ladder are preserved in a parallel position to each other, however they may incline on their respective center pins, on the same principle as the bars of a parallel ruler or Venetian window-blind, which likewise act in a similar manner to the steps of these ladders. The long platform, forming the upper and lower steps of each ladder, which are also the landing-places from one ladder to the next, are attached to the centre pins which unite the pairs of levers of the frame; and thus they are always kept in a horizontal position, and by means of the bar or rail behind the ladder all the other steps are kept horizontal

zontal likewise. The ascent is thus rendered extremely easy and safe.

Reference to Plate XI.

This Plate contains a representation of another form of machine likewise invented by Mr. Roberts for the same purpose as the preceding; but, being of a less expensive construction, it may perhaps prove of more general utility.

It is upon the same principle as the other, but has only three sets of levers or bars, situated parallel to each other, instead of four, arranged on the different sides of a pyramid: by this means a single screw is sufficient to elevate the whole. A A represents the frame of the carriage, mounted upon the four wheels B B B B. At one end of the carriage are fixed blocks C C C, for the joints of the lower ends of the levers A A A to be attached to; these are jointed to others, D D D, which rest, by means of rollers, on the frame; and the middle one has a block of wood, with a female screw, through which passes the screw E, on turning which the ends of the levers D D D can be brought towards the ends C C C, to elevate the machine; the other pairs of levers, which are erected upon the lower pair, will be readily understood, from what has been said of the first machine: observing first, that the three parallel sets C C C, &c. of levers, are held together by the centre pins which unite their joints, being common to all three, as is shewn at *a a a*.

The platform K, at the top of the machine, is supported from the upper pair of levers, G G H H, by rods I I, jointed to the ends of them, and also to the angles of the platform, by which means it is carried up parallel to itself. The ladders are formed within the frames, by rails or bars extending across them. There are two complete and

district

distinct sets of ladders in this machine, one marked L L L L, and the other *l l l l*, each extending from the top to the bottom of the machine; so that one person may ascend, and another descend, at the same time, without meeting each other. The communication from the top of one ladder to the foot of the next is formed by small landing-places M M M M at the end of each, which have a hand-rail *m* round them, supported by uprights *n n*, firmly erected upon the landing. These landing-places are preserved in a horizontal position, in all situations of the frame, by rods *p p*, extended from the hand-rail of one platform to the next, in a direction parallel to the great levers of the machine, which direction they will always maintain, because they form so many parellelograms, the sides of which will always remain parallel, as will also the ends. These are represented by the uprights *n n*, therefore these uprights, and consequently the landings, to which they are firmly attached, will remain parallel throughout the whole machine.

The two uppermost of the landing-places M M, being retained in a horizontal position, by being attached at right angles to the upright standards of the platform K, preserve all the rest in a similar situation; and which is still farther maintained by causing the extremities of the lower platforms O O O to rest upon the basis or frame of the machine likewise.

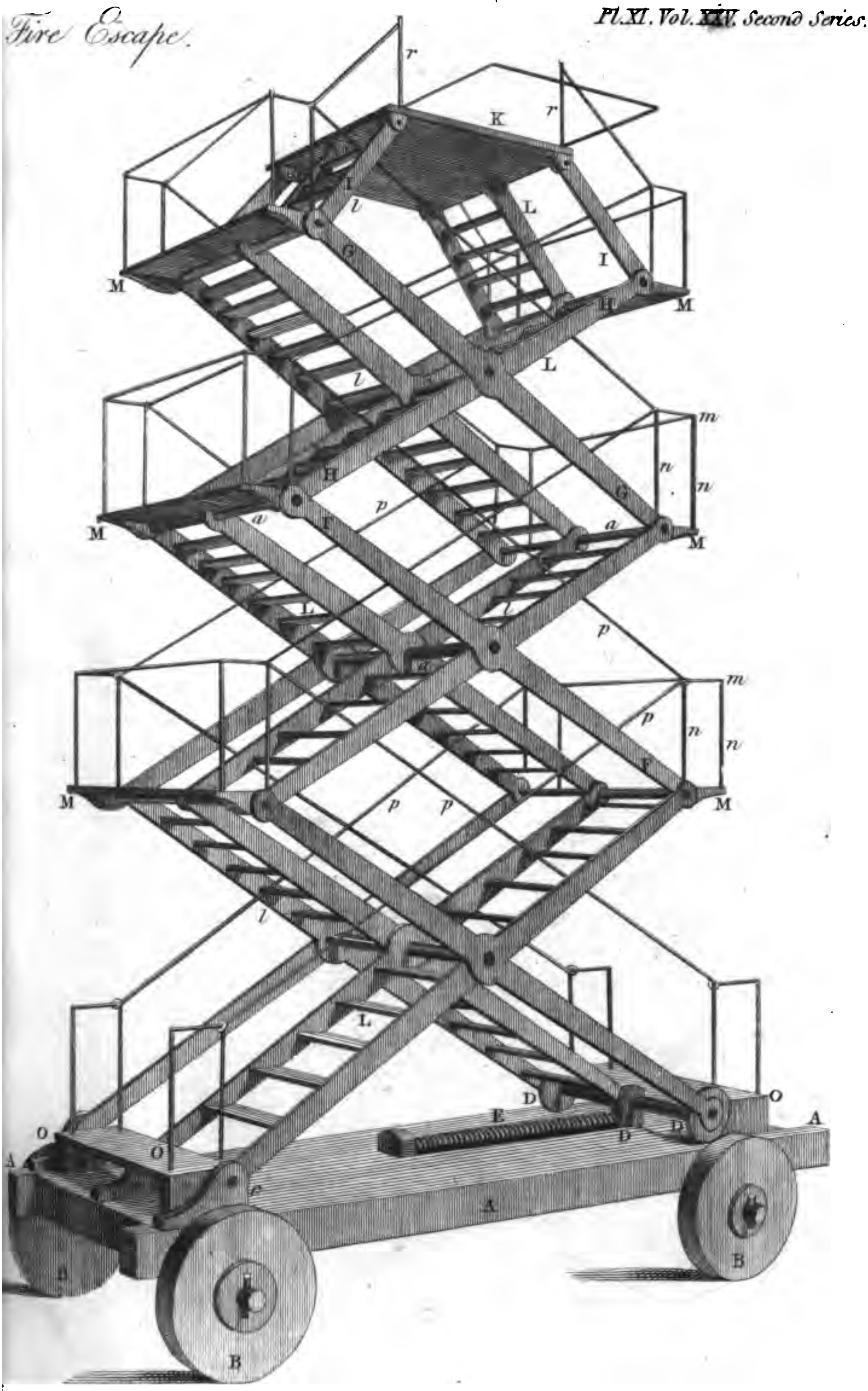
In this machine the steps of the ladder may easily be kept horizontal and parallel to each other, *viz.* by a rail carried behind the steps to connect them all together, they moving on centre pins, like Venetian blinds; the rails are also jointed to the landing-places at the top and bottom of each ladder, which being kept horizontal by the means before mentioned, all the steps keep so likewise.

On

Quadruple
Fire Escape.
B
e
e
a
a
A
c
10
10
b
8
7
6
b
b
b
F
F
F
F
E
E
G
H

Fire Escape.

Pl. XI. Vol. XXV. Second Series.



On weeding or cleaning Land.

By George Rennie, Esq. of Phantassie.

From the Communications of the Board of Agriculture.

WEEDS ought to be considered as robbers, that pilfer the food necessary for supporting the more valuable and useful vegetables. Viewed in this light, certainly all possible means for destroying them ought to be used; and if their total extirpation from the soil cannot be accomplished, their propagation should at least be checked, and their numbers diminished as much as possible. The weeds most commonly met with in this country are, 1. Couch-grass; 2. Knot, or nut-grass; 3, Dockins, or dock-weed; 4. Thistles; 5. Tussilago, or colts-foot; 6. Crow-foot; 7. Nettles; 8. Rag-weed; 9. Mugwort; 10. Mountain-daisey, a species of the white gowan; all of which may be considered as perennials. The principal annuals are, 1. Scelloch, or crop-weed; 2. Wild-mustard; 3. Spurry, or rhums; 4. Annual white Gowan; 5. Goose-grass; 6. Dornel; 7. Popple. To destroy these, and other noxious weeds, the operations of summer fallowing, horse and hand hoeing, with hand-picking, are commonly employed, though often with less effect than might be expected. The object of this paper, therefore, is to illustrate the nature of these weeds, and to explain the best modes of removing them; matters certainly of great importance to the practical husbandman, though hitherto too much neglected in many places.

I. Perennial Weeds.

1. *Couch-grass.* This variery of grass, the most inveterate enemy of every farmer, requires no description, be-

 ing

ing well known from one end of the island to the other. To keep land free of it requires unremitted care and labour, though it may be effected by frequent ploughings in the summer months, harrowing and rolling repeatedly, and, above all, by gathering with the hand every particle of couch that is brought to the surface after the several ploughings. Attention to these operations must never cease, otherwise the enemy will soon be restored to his primitive strength; but, if constantly bestowed, the labour of each rotation will gradually become more easy in the execution, and the expense thereof be proportionably diminished.

2. *Knot-grass*. This is a most baneful weed, and more difficult to be extirpated than the preceding one. It is called knot or nut-grass from the roots of the plant resembling a parcel of nuts fixed together, of different sizes. When this parcel is separated by harrowing and rolling, the single nut will lie upon the surface, exposed to the severest drought, for many weeks, without losing its vegetative powers; and when moistened by rain, or ploughed into the ground, will instantly grow again with as much vigour as if it had not been disturbed. In fact, there is no remedy against its pernicious effects, but carefully gathering the most minute fragment of the nut. Knot-grass also carries a large quantity of seed; so that no field, of which it is once in possession, can possibly be cleared without the steadiest perseverance of a farmer for many years.

3. *Dock-weed*, or *Dockins*. This abominable weed is very prevalent in many districts, and is a most troublesome enemy upon all wet soils where it once gets footing. It propagates both by root and seed; the latter of which is produced in such abundance, that one stalk is sufficient to furnish seed for an acre. Many negligent farmers,

when

when cutting their crops, allow the docks to stand, which is a most shameful and pernicious practice; as by the first gale of wind the seeds of the standing docks are blown over the whole field, to their great loss in after seasons. The only sure method of getting quit of docks is to pull every stalk that can be discerned during the summer months, especially at those times when the ground may have been moistened by rain, and to separate any that may still remain, from the corn at the time of cutting; after which the whole may be removed to the end of the field and burned. If the ground is not so wet in summer as to admit the pulling of docks by the root, they ought at all events to be cut over, which will prevent a fresh increase of plants from the seed for that season.

4. *Thistles*, though common enough on all old grass lands and pastures, are now kept within moderate bounds upon all well-cultivated farms. Of this weed there are three varieties, *viz.* the rough, or common thistle; the bear, or big thistle; and the soft, or swine-thistle. The same care will answer for them all, namely, good ploughing and regular fallowing, care being taken at the same time to cut and carry off any straggling plants that may happen to be among the corn crops, so as fresh seeds of this weed may not be sown. Old grass lands, of every description, and road sides, ought also to be annually cut with the scythe: a practice not so much attended to as it deserves.

5. *Tussilago*, or *Colts-foot*. This root is very hurtful to all lands under tillage when it once gets a footing, and till lately was considered as a weed which could hardly be exterminated. It flowers early in April, and sheds its seeds in the end of that month, or first of May, according to the state of the weather, always keeping as much

earth about its roots as enables it to remain in life in spite of ploughing and harrowing. Gathering the flowers has been resorted to as the means of extirpation; but as this weed continues to blossom every day for weeks together, the practice was found ineffectual. The writer of this paper, after combating this pernicious weed for thirty years, at last stumbled upon a remedy equally simple and efficacious, which is, to pull up the roots or stocks immediately after the corn is cut, at least as soon after as conveniency will permit. Upon examination it will be found, that around the neck of the stock, or root, within an inch of the surface, there is a parcel of buds, about the size of a pea, from which in the Spring the flowers, and of course the seeds, are produced. By pulling up the roots, therefore, which at that season is easily accomplished, the whole seed is at once destroyed. The best method of performing this operation is as follows: Put a number of boys or girls under the charge of a careful overseer, furnishing each of them with a small piece of iron, about the size of a boy's little finger, split up, like the toes of a hammer, at one end. By means of this simple implement the root will be easily extracted, at least to the depth of the buds, in the event of its breaking above them, when drawn by the hand. The roots must then be taken to a place of safety and buried; for, if laid on the sides of roads, or stone walls, they will flower in the ensuing Spring, in spite of all the rough treatment received in the digging process. If this plan be carefully followed for two or three years, success may be depended upon. It would, however, be proper in the spring season, carefully to look over the lands thus treated; and should either flower or root make their appearance, let it be pulled, and carried off immediately.

6. Crow-

6. *Crow-foot.* This weed, from its yellow flowers, is called *butter-cup* in England, the vulgar believing that it not only gives colour, but also adds to the quantity of butter, though this idea appears to be founded upon mistake. It abounds in all old meadow grounds, and is eaten by cattle in the early part of the season, when tender and young; but after it flowers and seeds no animal will taste it. Crow-foot also prevails in wet tillage-lands, and has the effect of binding the soil so close, as almost to prevent the growth of corn. As it requires much rolling and harrowing to make it separate from the earth, it can only be effectually eradicated during the process of summer-fallow, when it ought to be carefully picked and burned.

7. *Nettles.* There are three sorts of nettles which infest the ground, *viz.* the common nettle, that grows about old buildings, stone walls, and upon old rich pastures. This is a perennial plant, and can easily be got quit of by pulling it in wet weather by the hand, covered with a strong glove, an operation performed to the greatest advantage when the plant is in flower. The other two sorts are annuals; one of them, called *day-nettle*, is rarely seen in old tillage-land, but frequently appears in fields newly ploughed from grass, especially if recently limed; the other grows in gardens and on rich pieces of ground, but the injury from it is of small consequence.

8. *Rag-weed.* This weed makes its appearance in grass lands, and may be kept down by sheep, if put upon it early in the season. If allowed to get into full growth, no animal whatever will taste it; therefore, under that circumstance, the best way of destroying this weed is to cut it over before seeding, provided it cannot be pulled up by the root, which assuredly is the most effectual method.

9 and

9 and 10. *Mugwort* and *Mountain-daisy*. The same means may be used with success and effect in the extirpation of these weeds as are directed for the extermination of *dock-weed* or *dockins*.

II. *Annual Weeds*.

1. *Scelloch*, or *Crop-weed*. Of all the seed-weeds known in Scotland, this seems to be the most pernicious, occasioning immense labour to the farmer, and lessening the crops which he cultivates. This weed is to be found in greater or lesser numbers in all dry soils, particularly those which have been long cultivated; and so amply stocked does the soil appear to be with its seed, that though the weeds may be thinned and lessened from year to year, it seems physically impossible to remove them altogether. The scelloch, or crop-weed, has a small root, which it puts pretty deep into the ground; and its leaf, when about the size of a cabbage-plant-leaf, so much resembles that of a young turnip, that the one is often mistaken for the other. In the progress of its growth, which is very rapid, it puts out a middle stem, on which the flower is produced, and keeps growing to a considerable size, robbing and almost starving every other plant within its reach. It carries an immense quantity of seed, which is inclosed in an oily husk, and will, when lodged at a certain depth in the earth, out of the influence of the sun and air, preserve its vegetative powers for many years.

2. *Wild Mustard*. This weed is more nice in its choice of soil than the last-mentioned one, preferring rich dry gravels and loams, though often met with also upon clay soils which are in high condition. It is by no means so injurious as the scelloch, or crop-weed.

3. *Spurry*,

3. *Spurry*, or *Rhums*. This kind of weed does not branch out like the two former ones, having seldom more than one stalk, and puts forth a yellow flower, not unlike that of wild mustard, from which a pod is formed for the seed, in shape somewhat resembling a louse. This variety is neither so numerous nor hurtful as the two already spoken of, though to a certain extent its effects upon corn-crops are mischievous.

4. *Goose-grass*. This species of grass grows chiefly among wheat, and resembles a stalk of oats very much. Forty years ago it was very prevalent in Scotland, but is now seldom seen. The best method of getting free of it is to sow clean seed, and to take care that no chaff, wherein is the least mixture of goose-grass seed, be thrown upon the dunghill.

5. *Dornel*. This variety of weed appears somewhat like a stalk of rye-grass, and is found chiefly in barley-fields. The observation given with respect to the best method of getting free of goose-grass applies to dornel also. Some other weeds, such as those called *cock-combs*, *blue blaverts*, *gowans*, &c. &c. might have been mentioned; but as the cure for all annuals is the same, it seems unnecessary to notice them.

It remains now to speak of the most appropriate methods of keeping annual weeds within bounds, as their complete extirpation can scarcely be expected; and these may be confined to two measures. First, to bring the seeds in the ground within the limits of vegetation; and, secondly, to destroy every weed that vegetates, and thus gradually lessen the original stock.

In the first place, as the seeds of annual weeds are furnished with the means of preservation while stored in the ground, it is absolutely necessary to bring them into life before their destruction can be accomplished. This consists

sists in ploughing, thereby bringing the seeds to the surface; or so near to it as that vegetation will take place, which process may be hastened by harrowing and rolling the ground, till it becomes soft and reduced. In this way the seeds within two or three inches of the surface may be expected to vegetate according to circumstances, such as the richness of the soil, the fineness of the mould, and the degree of moisture which may prevail when the above processes are executed.

In the second place;—when the first crop of weeds appears above the surface a second ploughing should be given, by which that crop will instantly be destroyed, and a foundation laid for producing another. Harrowing and rolling should again be resorted to; and in this way several crops may be annihilated, especially in moist warm seasons, before turnips are drilled. When under that crop, both the hand and horse hoe should be constantly employed whenever weeds appear; and upon no account should a single one be allowed to run to seed. By paying due attention to these matters, many farms which, not forty years ago, were a nest of seed-weeds, have now been brought into order, that is to say, the weeds are kept under subjection, and easily managed.

To assist in these measures, it may even be necessary to hand-weed spring crops of corn in many instances, and also to bestow diligent attention upon cleaning beans, least one year's seeding, according to the old adage, should afterwards cause many years weeding. It is obvious, that by such attention a considerable diminution in the number of weeds must annually take place, till at last these robbers of the soil be brought into such complete subjection, that no regular and steady farmer need be under much apprehension of any bad consequences to his crops from their attacks.

Before

Before concluding this paper, it may be proper to state, that it would be of singular advantage to agriculture, were some general rules and regulations formed with regard to cutting and destroying weeds, especially those whose seeds are blown by the wind, and of course dangerous to the whole neighbourhood. That much and serious injury is often committed in that way is unquestionable; therefore, in my humble opinion, either some general law should be enacted upon the subject, or a clause or clauses be engrossed in every lease, binding and obliging the tenant to pull, cut, and destroy thistles, docks, and all weeds whose seeds are apt to be driven about by the wind, to the annoyance of others. The proprietors or tenants of all old grass lands should likewise be obliged to destroy thistles, &c. every year; and the like obligation should be laid upon tenants adjoining to the sides of roads, where weeds are often suffered to stand and shed their seed, to the manifest detriment of improved husbandry.

On the comparative Merits of Horses and Oxen in the Business of a Farm. By Mr. George Whitworth, *of Cuxwold, near Castor, Lincolnshire.*

From the Communications of the Board of Agriculture.

OBSERVING the Board of Agriculture desires to be informed of the comparative value of horses and oxen in the general business of a farm, I venture to give the result of my experience, and shall endeavour to make a fair comparison on this occasion; and if I offer any thing that will be at all acceptable to so highly-respectable an Institution in the course of this essay, I shall be

happy to be honoured by its publication for the benefit of my country.

I have been long in the habit of using both horses and oxen on a pretty large scale; and I am confident that, at this moment, both myself and all the farmers in this district employ too many of the former, and use the latter in too confined a manner. In this part of the kingdom the ox is rarely used in the plough: in the opinion of some of the most respectable agriculturists of the country, he is too slow to be profitably adapted to that part of husbandry; and I have often incurred much ridicule, and many severe sarcasms, from my neighbours, on making the attempt to plough with them in the manner of horses; but I am rewarded by my success; and I hope before long to perform a considerable part of the business of the farm with them.

The oxen I plough with are of a mixed breed, between the Durham and Lancashire sorts; they are large, and tolerably active; their harness is chiefly of wood,—the cost of it is about 15*s.* *per* ox. I use two to one plough (the common swing plough); they go abreast—are guided by lines, and are as docile as horses. They work with my horses every day, and I dare say would be happy to be fed with them; but this they are denied; for though they contribute so much to producing the corn, they rarely taste it; however, at the close of the last turnip season, I was obliged to press the oxen very hard, and I then gave each of them half a peck of split barley, which seemed to benefit them considerably; and had it not been for their aid, I should not have been able to have sown my turnips in season, the horses being unable to work half the proper time, from a distemper which much resembled the strangles, and which the same horses have experienced, or something very like it, repeatedly. I was

was anxious to shew how far I had brought my cattle to be useful, and accordingly I sent two pairs of them to a neighbouring ploughing meeting, but not with the hope of obtaining a prize; for it never struck any one, who had the direction of the business, that the ox could be made to go a sufficient pace to be placed in competition with horses; and I understand the surprise of the meeting was very considerable, at both my ploughmen finishing their lands before several very good horse teams had ploughed the same quantity. Of this I inclose a certificate, sealed up as the Board directs, and will furnish any other particular which may appear to require a voucher.

The horses I used for the plough, before I began with oxen, upon strong work, were short-sized ones, of the black cart breed; conceiving this description to possess sufficient strength, and more hardihood than larger animals, and certainly more capable of quick motion; and, I am of opinion, requiring less food generally. I am rather confirmed in all this, from having occasionally worked heavier and larger horses, and finding them seldom do well with me: they may be very superior for the dray or waggon, where amazing weight and great exertion must be occasionally combined; but a farmer has seldom a load of such a description, but part of it may be left till another day, which is much better than distressing his team; and where a load so extremely large occurs that there is a chance to injure the cattle, I should prefer oxen. Two of them, I think, are allowed for one horse in all the highway acts, and pay no more generally at the toll-bars: they pay no tax: and I hope to see the day when there may be further encouragement to use them.

From what I have advanced, it will almost be consi-

dered matter of surprise, that I continue any horses upon my farm; but though I think my oxen vastly superior to my horses, taking the expense of keep and the labour into the account, (the latter of which, in a general way, is equal, whilst the former is always in favour of the ox,) there are departments where I give a decided preference to the horse; for instance, the light harrow, and even the plough, on my lighter soil for turnips: at the last ploughing I would draw by a half, or even a full blood-horse; some of these I use to advantage at that time; and the ox works the heavy harrow, or is employed at the dung-cart: indeed, in all light work, where extremely quick motion is possible and desirable, I find the blood-horse a better animal than my ox, and the blood-horse only. Against any of the cart breed I would not scruple to match the ox at any work that can be named; and I rather think an individual ox might be matched against any horse whatever for a period of twelve months: from the former being subject to so few diseases, and the latter to so many, I should calculate upon the ox being the winner.

The ox is objected to by many farmers, because they consider their pastures are not sufficiently good for their support in summer; but this I regard as very unwarrantable; for I believe fully from my own experience, that an ox may be kept in any situation where a horse will thrive; and when at large, I find the latter more inclined to break his pasture than the former. Indeed, I do not know so great a plague upon a farm, as the horse when he is not constantly employed; he is always in danger, and you seem to be keeping him without an object. On the other hand, the ox is generally quiet, and satisfied with the rest allowed him; he grows and improves considerably, and pays amply for his keeping, by the addition

tion that is made to his size and weight. Many contend that the farmer may, by working young horses of the cart-breed, make a considerable profit; but I do not generally find it so, but on the contrary; for at four years old (before which time this animal is not of much value for work) he is almost at the height of his worth in the market, and in a few years he rapidly declines; and, in the estimation of the dealer, at nine or ten he will sink perhaps a third from the price he first cost. From four to eleven I consider the horse to afford the most profit to the farmer; but it is from his labour, which for the last six years of that period will be so valuable, as to counterbalance the declension in his price. In some situations a three years old horse may be used, but generally they are not of much value at that age; and after eleven or twelve they decline so much in most instances as to be unprofitable to the farmer; they are slow after that period, usually require more support, are subject to diseases in their legs, often deaf, affected in their wind; and the mares that have been well kept and hard drawn, and that have not bred before, will often prove barren. Some keep mares in preference to colts, occasionally breeding from them being a leading inducement; but I do not consider them of more value on that account, because the farmer, who has a number of his mares with foal, must be under the necessity of filling their places with other horses at a season when every one will most want; of course he must give a high price if he purchases, or, which will be the same thing, hold horses of his own at a great value, which he would not otherwise have kept. Where mares are worked fairly only, and kept up, which is usually the case at the time of putting them to the horse, they will prove barren perhaps twice in three times. I think I have found it so; and those that breed

require

require more attention than is usually given to them, amongst a number of working horses; therefore it may not be, on account of the uncertainty and hazard, very advisable to put mares that are constantly employed, to the horse. One advantage in using mares may be the breeding from them in case of accident, or when they decline in value; and if they are good ones, and of a respectable stock, it is a very great one; and another recommendation to many is their not costing so much in the first instance as colts; and of course where lameness occurs, or total loss, it will be easier borne. But the ox must here be of much more importance than the horse; for I find, by experience, that an injury that totally ruins the latter, does not, in many instances, much affect the value of the former.

I break in my oxen when about three years and a half old; and I consider I work them profitably about four years, when I turn them away, which is usually when the turnips are sown; they are generally in such condition that they make tolerably good beef by Christmas, without resorting to corn or oil cake. In the turnip-sowing-season, a farmer requires all the force he can muster, and at this period he breaks in the young oxen to great advantage; with gentle usage they are tolerably manageable in four or five days; and I earnestly recommend it to every one who has any concern with them, to treat them with humanity, gentleness, and kindness, and the driver will be amply repaid by the docility and willingness of his cattle. The ox may not be endowed with so high a capacity as the horse, but he is an animal of no mean instinctive powers, and seems to be the most patient and obedient of all our domestic animals: he will apply his neck to the yoke as often as the driver will direct, and exert all his power, even where the object is so

fixed

fixed as to be made no impression upon, and he will not refuse this in the deepest and most miry road. In leading of timber in woods this frequently occurs; and here the ox is very superior. The horse will in this situation be of little worth compared with the ox. The finest horse-team, with the most skilful driver, after the carriage once sticks, will seldom extricate it; after two or three efforts these animals begin to look behind them, and the waggoner may cherish, or use severity, without any avail: indeed, I have seen such a disposition made, that the fair exertion of two horses would have taken the carriage out, when four or five that have once experienced its sticking will pull in so disjointed and ineffective a manner as to be only calculated to break the harness, and tire the patience of all concerned with them. Every one who has had to do with horses will occasionally have observed this; and in deep clay and heavy roads, those who have witnessed the steady and even exertion of the ox, must prefer him greatly to the horse, which will here, whilst his wind remains, be scarcely governable, and when that is gone, he either tumbles down, or the carriage sticks fast. Some who are willing to allow the ox some merit, ask what he will be in hot weather, when the gad-fly, as it is commonly called, is troublesome? I answer, this insect, or some one much resembling it, is equally tormenting to the horses, as every traveller must have experienced. The ox tribe, it is true, when at large in the pasture, will erect their tails and run in herds when this fly approaches them, and, on account of the shade the hedges afford, they naturally make directly for them, and occasionally break their pasture; and from this it is inferred they will be liable to start when in harness; but I can positively affirm this never occurred with my cattle; and as to heat, I find them able to bear it as well as horses,

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at least. I should expect the ox that is kept below his work will sink in a moderately warm day; but if he is stout, and fairly kept, (and surely humanity ought to forbid our attempting to use an animal that is too low to perform a fair day's labour without distressing him,) we do not doubt his performing vastly well. As a proof of the ability of the ox to work in hot weather, I can assert, that mine were employed at the dung cart on the thirteenth of July 1808, (the hottest day probably known in this island,) and they were not in the least oppressed by it.

As to the quantity of food the horse or the ox will consume, it can, I consider, be of no importance to state any instance of it, as it will continually vary in different animals; and all I think right to observe on this head is, that the most compact-made animals of both sorts will in general require least support; but I have known some of this description enormous eaters. An ox is certainly kept at an easier rate than a horse; in the summer he is of value amongst the sheep, making the pasture better for them; whilst the horse is, by eating so near the ground, and feeding only where the sheep will graze, particularly injurious *. In the winter months a coarser sort of food will do vastly well for the ox-team; hay and good oat-straw, mixed half and half, cut into chaff, is all that is necessary when the work is not severe, and this is all I allow mine in common; but when I am under the necessity of pressing them severely, I gave about a peck of corn to each pair, generally barley ground or split. I should allow a peck of oats to the horse that I expected

* The horse feeds perpendicularly downwards with his fore teeth, as does the sheep; whereas the ox feeds by his tongue, at the side of the mouth, by which means he can only take the coarser grasses refused by the sheep.

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the same work from; and I think it but fair so to treat that animal, that whilst he is labouring for us he may be comfortable, which all consider of so much importance when he is dead. I do not know why many who use oxen should refuse them corn at all times *; they surely are as deserving of it as horses, and will, I am certain, from my own practice, pay for it in general much better. A peck of good oats with good chaff, such as I before spoke of, never makes a horse fat that does a fair day's work; and when we see a horse-team in very sleek and fine condition, abounding in flesh, we may fairly conclude they are either over-fed or under-worked, or perhaps both. If it can be done, I should advise that the oxen are favoured as much as possible the last few weeks of their working; they will of course be much fresher and feed better. When oxen are turned away to fatten foot-beaten and worked down to mere skeletons †, we must not expect them to lay on much beef during the whole summer; this abuse has, I consider, done more injury to the cause of oxen, as beasts of draught, than every thing else combined. Many of the graziers I know in this district object to old oxen, because they lie long upon the ground, as they term it; and well they may, when so many of them are only just able to rise from it when they are turned away to fatten. With those who work oxen in

* Instead of allowing corn, substitute turnips; an additional motive for which is, that it will cool the animal, heated in some degree by labour, whilst the saccharine property of the turnip nourishes at the same time.

† To turn oxen to graze in very low condition must at all times be avoided; for they not only take much of the best part of the season to come round, but they are too apt to be scoured, as every poor animal is, by strong herbage. Many oxen, and thousands of sheep, are thus destroyed.

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this district there is scarcely any system: sometimes a farmer will use a few pairs for taking out the manure, and harrowing the rough land after the second ploughing for turnips, and then for some years again he is without an ox upon his farm; of course the labourers are in general prejudiced against them, not considering if they were brought into general use, they, as well as the whole of the working people of this island, might oftener sing "The roast beef of old England," with a comfortable piece upon their table for themselves and families. The quantity of corn saved would be very considerable; for the ox, except he is worked very hard, will not require any; mucilaginous food agreeing with him generally better than farinaceous. From the circumstance of his being a ruminating animal, he will not ask that constant feeding and attention which the horse necessarily demands: he will fill his stomach in a short space of time, and afterwards lie down and take his rest: he will thus, the moment he has been fed, leave the ploughman at liberty to follow any other business upon the farm, whilst those attached to horse-teams can do little else but wait upon them.

I never shoe my oxen, and they never seem to require it; but I believe some may, their feet being more tender. I am told this is the case with the highest bred Durham cattle; but whether this sort is so useful for the yoke as many other breeds of the island, is with me a question. I cannot speak exactly from my own experience, but, from what I have observed, the Sussex and Devon breeds are the most desirable as beasts of draught. I am about to try the Sussex; and when I have experienced sufficient to warrant my speaking of their merits, I shall be very ready to communicate any fact that may be of sufficient importance to be published. Having, I trust, been

been as particular as the subject demands, I conclude by observing, that it will be a great pleasure to me to find, by the notice of the Board, that I have fully understood their intention.

CERTIFICATE.

We, the undersigned, beg to declare, the two ox-teams belonging to Mr. Whitworth, of Cuxwold, in the county of Lincoln, ploughed half an acre of land each at Horganby, in a superior manner, on Thursday the 5th of March 1812, in less time than several very good horse-teams which started for the premiums; and that we were so satisfied with their performance, and lamenting there was no prize offered for ox-teams, begged, on behalf of the Society, to present the men ploughing with them with a guinea each, which was unanimously agreed to.

JOHN KIRKBY.

April 20, 1812. J. W. SWAN.

Method of preparing Leather and Skins in the Manner of the Kalmuks.

From the BULLETIN DES NEUESTEN.

TO prepare fine lamb-skins, they are first washed in warm water, and, after spreading them in the air, to let them dry a little, they are cleaned, by scraping with a blunt knife. This operation is intended not only to clear the skin from the fibres that adhere to it, but also to dispose them to receive with greater facility the milk which is afterwards applied to them. When the operation of scraping is completed, the skins are spread in the air on the hairy side, and are moistened for three days with sour cow's milk, to which a little salt is added. This

operation is renewed three or four times a day: on the fourth day they are suffered to become dry, and they are then rubbed between the hands and on the knees, to render them supple. They are afterwards suspended in smoke, in order that they may the better resist rain, and that they may not be injured by moisture. To this effect a small pit is dug, into which are thrown rotten wood, dry dung, and other substances, which produce a plentiful smoke, sheep's dung has the preference; round the pit are placed poles, which, being made to meet at the top, form a kind of pyramid, and are entirely covered with skins, so that none of the smoke can escape. They are turned from time to time, until they are all penetrated by the smoke equally in every part, and at the end of an hour they are removed. As they are then rather hard, they are rubbed between the hands to soften them.

Lastly, they are coated with powdered chalk, then scraped, and smoothed with sharp knives: the chalk is again passed over them, and they are beaten, in order to clean the hair. So much care is not required in the preparation of the common skins. It is found to be sufficient to pass over these skins a mixture of ashes and salted water, which is more or less caustic, according to the thickness of the skin. They are left for one night in this state; the next day they are scraped, and sour milk is washed over them, at several times; they are then left to dry, and are afterwards rubbed with the hands, and bleached with chalk.

The furs which the Kalmuks use are sewed together by the women with the fibres of the horse, the bull, or the elk, which they prepare by drying, beating, and afterwards drawing them out. The seams made with these fibres are stronger than any that are sewn with the best spun thread.

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The ox and horse hides, which are generally employed for harness, are tanned in the following manner: The skins, while yet fresh, are heated in boiling water until the hair comes off. They also cover them with ashes, in order to obtain the same effect. Both sides of the skins are scraped with sharp knives, and made as smooth as possible; and they are afterwards washed with clean water. They are then left to soak, for a week or more, in sour milk, a little salted. In this manner they prepare the thinnest skins for boots and strings. They fabricate with ox leather, especially the back part, vessels and bottles that are as hard as horn, and which are much used by the Kalmuks. For this purpose they spread the skins in the sun as soon they are taken out of the water, and cut them into pieces of a size suitable to the vessels which they are intended to form. They sew them while they are still wet, with the fibres of animals, and then dry them completely in smoke.

In this manner the Kalmuk women not only fabricate vessels with large necks, to which they give whatever form they desire, by fashioning them with the hands as they dry, but they also make bottles with narrow necks and decanters by continually blowing and holding them over a fire, or they fill them with ashes and sand. They also ornament them with figures, which are executed with much delicacy. There have even been seen among the Kalmuks large tea-pots of leather, very well formed, and having narrow tubes like ours.

The vessels thus made are used for domestic purposes; and that they may not be softened by moisture, or communicate any bad taste to the liquors that are kept in them, they are exposed for several days to smoke, in the manner above described, which renders them as hard and transparent as horn, and very durable.

Notice

Notice upon Alcohols or Spirituous Liquors, and on the Changes which they undergo by their Rectification with alkaline, saline, and earthy Matters, &c.; followed by a simple Process for obtaining the most dephlegmated Spirits of Wine, without altering its constituent Principles. By M. Dubuc.

(Concluded from Page 174.)

By pure Alumine and by ordinary Clay.

To a litre of alcohol, at 39 degrees, I put eight ounces of pure alumine, well dried; after two days immersion, and always at the same temperature, I decanted, with care, a sufficient quantity of spirits of wine, and I observed that it gave 40 degrees; it was afterwards distilled in a water-bath to dryness. The liquor extracted had a pungent smell, very disagreeable, and marked 41 degrees. I heated the alumine rather strongly, in order to drive off about 32 grains of moisture, which it had taken from the alcohol, and then re-distilled the alcohol upon this earth. The liquor acquired by a second rectification 42 degrees. This alcohol has constantly all the properties which are characteristic of good spirits of wine; the smell, the taste, and the re-agents, do not detect in it the presence of any foreign body: its specific weight is very near that of water : : 8.292 : 10.000.

Alcohol may also be obtained at its highest degree of rectification by employing, instead of pure alumine, the ordinary potters clay, well washed, then passed through a sieve, and, lastly, made perfectly dry before it is employed for this operation, (it requires about one-third more than of pure alumine); but it is in vain to attempt to lessen by this means the specific gravity of the alcohol, as I was convinced by successive distillations and recti-

rectifications of these matters: whence I concluded, that this earthy substance has not any action on the elements of the alcohol, and that it only takes the superabundant water from its spirituous essence. In consequence, and as we are ignorant if this intermedium has already been employed in a similar case, we propose this new method, with confidence, for making spirits of wine with facility to a very strong degree; and we estimate, from our experiments, that this liquor, when *most rectified,* and not altered in its constituent principles, should always mark 42 degrees of the aërometer of Beaumé, *mean temperature.* We add, that alcohol, at a higher degree, distilled upon saline intermedia, is more or less altered in its constituent principles; that nevertheless it may be used with advantage in the preparation of varnishes for perfumers and clock-makers, for defending metal work, &c. &c. but these liquors can never be substituted for the brandies of commerce.

We believe, farther, that alcohol, rectified upon saline or alkaline matters, even reduced to a proper degree, cannot be employed in pharmacy in the formation of numerous medicaments, of which spirits of wine is the excipient, because we believe that these preparations would acquire new properties, which might occasion unexpected effects.

We shall now conclude, with a few general observations on the alcohol or spirits of wine produced by the fermentation of all sorts of mucous-sugary matters.

Since the fine experiments of Lavoisier, and several other chemists, we know that the inflammable liquor, known by the name of spirits of wine, is composed of carbone, oxygen, hydrogen, and a little azote, according to M. Saussure. But it has been concluded pretty generally, that all alcohol, from whatever substance produced,

duced, should be perfectly identical and homogeneous in its elementary principles, because, it is said, since it is composed of the same radicals, the proportions of which are known, it ought to have the same properties, the same taste, to be equally affected by the re-actives, being well purified, and at their highest degree of rectification.

This alcoholic identity may be within possibility; but I own I have never been convinced of it, for notwithstanding the numerous trials I have made for twenty-five years on the alcoholic fluid produced from wine, cider, perry, cherry brandy, fermented grain, &c. I have constantly remarked that all these liquids, distilled and rectified several times, even in water or vapour baths, without mixture, or by the intermedium of charcoal, in the manner of Lowitz, and brought to the highest degree of rectification, would still discover their origin, and that it was always easy to say, this alcohol is produced from wine, that from cider, that from perry, and so on.

The odour that proceeds from the alcohol on rubbing it between the hands, its taste when diluted in a sufficient quantity of warm water, its mixture with a little sulphuric acid, are the most simple and certain methods of detecting the particular *aroma* which distinguishes each of these liquors, and indicates the liquor from which it is produced. There, nevertheless, exists a term at which all these alcohols cease to be distinguishable; but then they are *denaturalised,* if we may use the expression; which happens in consequence of their *etherification.* Indeed that fluid, which is extremely volatile, very odoriferous, very expansible, and long known by the name of the ether of Frobenius, which is prepared by distilling together equal parts of alcohol, at 36 and 37 degrees, and concentrated sulphuric acid, may be made from every kind of spirituous

rituous liquors, and when the product resulting from it is well rectified, and marks from 36 to 60 degrees of the aërometer of Beaumé, then I do not hesitate to advance, that in this state it is impossible to discover from what kind of alcohol this ether is prepared: it seems, at the instant of the effusion of the acid on the spirituous fluid, that its characteristic aroma vaporises or is destroyed by the *disassociation* or alteration of the elements that compose it *.

I shall add, that the different sorts of alcohol, at an equal degree of rectification, do not always produce the same quantity of ether. I have met with some kinds that have yielded one-sixteenth more than others. Is this owing to the heterogeneous principles which they contain, more or less, or to the various proportions of the elementary substances from which they are composed, or to a more considerable quantity of *aroma*, which I believe to be inherent in every sort of spirituous liquor?

Without seeking now to explain these variations, I shall only notice, that the alcohols which appear to yield the most ether, are those extracted from perry, wine, and cider; those from Kircheuassor, rum, gin, and brandy made from grain, give a much inferior quantity.

* By the effect of the re-action of the concentrated acid on the alcohol, and by the aroma that proceeds from it, one may always distinguish the nature of the ardent spirit employed in this operation; but as soon as the mixture is half cold, then the liquor that results is perfectly *identical*, as to its smell only, but the colour is more or less *intense*: this appears to depend on the different proportions of the oleaginous aromatic principle, which characterises each kind of alcohol, and on which the acid particularly acts by carbonising it, &c. &c.

On the Composition for tinning the Backs of Mirrors.

From the Bulletin de la Societé Encouragement.

THE Committee of the Chemical Arts of the Society of Encouragement have been charged to examine the mixture employed by M. Verea, for the tinning of looking-glasses, and to find out its proportions, and thus to complete the remarks transmitted by the author to the Society. The Committee has besides entered into some details on the application of this process, and has presented to the Society a particular report on this object.

M. Verea made three experiments in the presence of the Committee; he employed each time a different mixture; twice he brought with him what he had occasion to use; but at the third sitting, some tin and pure lead were given to him, and of which he at length used an ingot, containing 61 *per cent.* of tin and 39 of lead.

The metallic leaves that were obtained from this mixture were much better than what he had made with the metal which he brought for the second experiment, but not near so good as those that were produced from the mixture that he brought when he first came to the Committee.

After each experiment a seal was fixed upon a piece of the mixture employed. The ingot, No. 1, being the mixture which had produced the finest sheets or plates, and the best tinning on the glass, was that of which it was most important to ascertain the composition. It was analysed with all possible care; and the following results were obtained. This mixture much resembles the solder used by plumbers, it has the appearance and fracture of common tin vessels; its surface is smooth, and without any

any appearance of crystallisation. Its specific weight is 84,921; it cuts kindly, is very ductile, and rolls easily into very thin sheets. The analysis, twice repeated, has proved that it contains, *per cent*, 65 of tin, 35 of lead. To verify the results given by the analysis, 650 grs. of tin and 350 grs. of lead were melted together, and with this mixture some metallic plates were made, as good in all respects as those which M. Verea had presented to the Society.

This then is the nature of M. Verea's mixture. There is no difficulty in its preparation, since it is only necessary to melt in an iron ladle or a cast-iron boiler 65 parts of fine tin, and to add 35 parts of pure lead, to stir the mixture well together, to run it into an ingot, and to leave it to cool in the same vessel, at least when it is not used directly.

I. *On tinning Mirrors, and on the Fabrication of the metallic Sheets or Plates made by M.* Verea's *Process.*

The process employed by M. Verea, whether for tinning mirrors or making metallic plates with one surface perfectly polished, is as follows.

It is begun by fixing upon the glass intended to be tinned, or with which the metallic plates are to be made, a piece of cork or wood, glued to the centre, on the least polished side, so as to form a handle, by which it may be held. The glue being dry, and the cork firmly fixed, the mixture having been previously prepared, is melted over a slow fire, in a flat vessel, of about double the surface of the glass that is to be tinned.

When the metal is well melted it is slightly agitated, in order to render the mixture homogeneous; the surface is skimmed by drawing a card or strip of thick paper over it; the surface of the glass, to which the metal is

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to be applied, is moistened by gently breathing upon it; it is carefully wiped, in order to clean it; it is slightly heated, in order that it may not break at the moment it comes in contact with the melted metal; it is again wiped; and when the mixture begins to thicken on the edges, the card or strip of paper, which is held in the left hand, is passed over the surface of the melted metal; the plate of glass is immediately applied to it, and then detached by raising it, not vertically, but in a curved direction from right to left, of which the centre of motion is the top of the piece of cork which serves as a handle; a slight shock is given to it, in order to shake off the melted metal that adheres to the lower extremity of the metallic plate, and which without this precaution would be of an unequal thickness.

If the operation has been well performed, the bed of metal that is applied to the glass, and which cools and becomes solid in the same moment, will adhere to it so as not to separate from it when the glass is raised from the surface of the melted metal.

We see that if the metal be too warm it cannot form a solid metallic pellicle on the surface of the glass: that the same difficulty occurs if the glass be too hot, or if it be left too long upon the melted mixture. The metallic plates, on the other hand, are too thick when the metal is too cold, or when the glass has not been made sufficiently warm. They are tarnished and covered with streaks when the metal has not been well skimmed, also when the glass has not been instantaneously applied, and with all the necessary care, or when the mixture contains either copper or iron, because these metals give it the property of crystallising with facility while cooling.

It would be useless to enter into more particular details on the practice of this process, because habit alone is

is necessary to be enabled to give to the metallic plates made by his means the suitable degree of brilliancy and thickness, and this habit is easily and cheaply acquired, since a great number of trials can be made in succession, and the faulty plates being re-melted, no sensible waste is incurred.

The metallic plates prepared in this manner adhere to the glass when cooled with so much strength, that it requires a certain degree of force to separate them. A point or the blade of a sharp knife must be passed between the edge of the glass and the metal; and a little air thus introduced between the two surfaces, renders it easy to separate the metallic sheet from the glass. This sheet or plate has the polish of the glass on the side that was in contact with it; the opposite surface, on the contrary, is unequal, rough, and covered with crystals, which are larger and more numerous according as the tin and lead employed in the preparation are more or less pure. M. Verea operates thus: If the contact of the metallic plate with the glass be not so exact or perfect as it ought, and the image of the objects reflected by it not so clear, he is obliged to glue a strip of paper on the edges of the glass, in order to prevent the air, and especially any dirt and moisture, from entering between the glass and the metal, which without this precaution would be liable to oxydate and lose all its brilliancy.

When the metallic plates are to be prepared, the same glass may always be used, as long as the plates are required to have the same surface, only the glass must be carefully suffered to cool when it becomes too warm to give the plates the right thickness; and this may be easily done during the time that the mixture is being warmed when it becomes too cool. If it is desired to make metallic plates by this process of more than 400 or

450 square centimetres, it will be necessary to resort to some mechanical method of applying the glass to the surface of the melted metal, and of separating it again immediately. This difficulty is mentioned, in order to direct the attention of mechanicians to this new object.

II. *Comparison of the old Process of tinning Mirrors, in which Mercury and Tin are employed, with that of M.* Verea, *and of the different Applications that can be made of this new Method.*

The Committee have made comparative trials in tinning mirrors according to the old process and that of M. Verea. From these experiments they conclude: The tinning which M. Verea proposes is, at an equal surface, seven times heavier than that which is prepared of mercury and tin, but it does not cost more; which is thus to be accounted for; in the old process they use pure tin, reduced into sheets or plates, which is worth, at an average, almost three times as much as block tin, while in the new process only tin in ingots is needed, and which may not possibly be perfectly pure. Nevertheless, these two processes cannot rank together, especially for mirrors of a large size.

M. Verea's tinning is not so brilliant as the other; it always appears more or less leaded, and would besides be attended with the inconvenience of rendering large mirrors so heavy that they would be difficult to move, and much more exposed to fracture by the least shock. It is also to be feared, that the adherence of the metallic sheet not being complete, or ceasing to be so in consequence of the unequal dilatation of the glass and the metal, at length renders the glass so far tarnished as to reflect objects but imperfectly.

M. Verea's process therefore appears to be only applicable

cable to the tinning of mirrors of small dimensions, but especially to concave or convex glasses, of plain or cut surfaces, which cannot be tinned by the old process, or can only be done badly, and with much difficulty; also to the tinning of mirrors employed in the construction of camera obscura, microscopes, &c. which being exposed to the direct action of the sun's rays, soon cease to reflect objects, if they are tinned in the usual manner, because the amalgam of mercury and tin, softened by the heat of the sun, runs to the bottom of the glass, or at least it ceases to form a continued sheet.

The greatest advantage of M. Verea's process is the power of making with facility metallic sheets or leaves, having one surface, perfectly smooth and brilliant, and this advantage is capable of being applied to numberless useful purposes.

Indeed, the Committee are of opinion, that this new process may be used in various arts for making metallic plates perfectly brilliant with little trouble.

Report made to the Class of Natural Philosophy and Mathematics of the National Institute, on the Use of Zinc for the Fabrication of Measures for Liquids, and for Vessels and Utensils for the Use of the Military Hospitals. By Messrs. PORTAL, BERTHOLLET, DEYEUX, VAUQUELIN, and GUYTON MORVEAUX.

From the ANNALES DE CHIMIE.

THE Minister of the Interior having invited the Class to name a commission, in order to examine if zinc vessels could be employed without danger in the usual measures for liquids, and the War Minister having also requested its advice on the question, whether zinc vessels could

could be used in the place of copper in the military establishments? The resolution of these two questions being founded upon the same bases, the Class gave them for the consideration of the Committee under the same head.

We shall begin by giving the principles and experiments on which we have established our conclusions, and we shall finish by applying them to the objects on which their Excellencies have consulted the Institute.

It is but too certain that the vessels which are habitually employed for the preparation of our food is so much the more dangerous, as the surface of the copper, which is the principal material, is only defended by the best tinning, with a coat of tin, of less than $\frac{11}{100}$ of a grain in thickness to the square inch, which becomes every day thinner, and entirely disappears with the least rubbing; it is not surprising, therefore, that renewed efforts are incessantly made to substitute for this material some other, that may be less dangerous. The object is too interesting to humanity not to be encouraged, and favourably received; but no means hitherto proposed have accomplished this end; and it may not be useless in this place to give a short account of what has been done.

In 1779 the celebrated Rinman published, in the Memoirs of the Academy of Stockholm, some trials, which induced him to hope that he should be enabled to cover the metal, which is necessary to give strength to these utensils, with a vitreous coat or enamel sufficiently adherent, and susceptible of following, without rupture, the change of dimensions occasioned by difference of temperature, and more or less sudden cooling.

About thirty years ago an attempt was made in England to improve M. Rinman's processes, and Mr. Wedgwood, the son, remitted to one of us a cast-iron coffee-pot,

pot, the interior surface of which was lined with a white enamel. It was immediately discovered that this lining, which was similar to bad pipe-clay, did not resist the action of the weakest vegetable acids. M. Chenevix gave the same judgement from his own experiments.

In 1802, the Society of Encouragement proposed a prize for the fabrication of metal vessels lined with a solid and cheap enamel. The plates and specimens of enamelled iron that were presented in consequence in 1808 gave them the greatest hopes of at length obtaining the solution of this problem from the report of M. d'Arcet, in the name of the Committee of the Chemical Arts, of the experiments to which these pieces had been submitted. It appeared that the author, M. Schweighauser, a physician at Strasbourg, could not continue his researches on the subject; but at the same time that he renounced the prize, being desirous of serving the science, and of assisting those who aspired to it, he communicated to the Society the compositions and processes which had furnished him with the best results.

It was hardly to be expected, though we might hope, to obtain from the application of a vitreous composition to the metal to supply the place of copper in domestic use, or at least to cover its surface with a more solid material than the ordinary tinning; zinc was already thought of even before it was known to be possible to work it with a hammer.

Magraff was the first who announced, in 1746, that by purifying it from all foreign matters by distillation, it might be *beaten into plates tolerably thin*. Notwithstanding the just confidence that was already placed in the labours of this chemist, so little attention was paid to this discovery, and to the use that might be made of it, that they not only continued to work the zinc mines solely for

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the fabrication of brass, but the editor of the Dissertations of Pott still refused, in 1769, to credit what he reported, from the *tuda trifida*, that the zinc which came as ballast in the ships from India was employed *to cover buildings, zinc,* he says, *not being malleable.* In 1781, Crell announced, in Germany, that M. Sage had been enabled to laminate it, and that he had sent to M. Schmiedel some leaves that were as thin as paper.

We have said that the first trials of zinc for domestic purposes had preceded the discovery of the processes by which it can be rendered ductile: we see, indeed, that in 1742 utensils were presented to the Academy of Sciences in which zinc supplied the place of tin, and, what is remarkable, the Academy then thought they might allow the *salubrity of this lining.* But this opinion was much shaken on the report made by Maquer, in 1777, that a vessel, presented by the Sieur Doucet, was attacked, even cold, by distilled vinegar, which left at the bottom, by spontaneous evaporation, a white ramified crystallisation; it was recollected, that the vessels made by the Sieur Chartier, which were also *lined chiefly with zinc,* were judged by the Academy, some years before, to be *attackable by acids and neutral salts.*

This did not prevent a chemist of some estimation, M. de la Folie, of Rouen, from maintaining, the following year, that lining with zinc was much less dangerous than the common tinning, in which he says, the tin is alloyed with one-third of lead, and often conceals a little arsenic; and he affirmed, that he was served constantly for more than a year from iron vessels lined with zinc, without observing that they communicated to the food any metallic smell or bad taste.

In the same year the Sieur Biberel presented to the Academy some vessels lined with a new sort of tinning,

which, on the report of Macquier, obtained the approbation of that Company, and afterwards that of the Office of Consultation on the Arts. We cannot appreciate this composition, which the inventor has kept secret; but we must not leave it unnoticed, that his processes when reproduced by his son, doubtless with improvements, after thirty years of oblivion, obtained encouragement from the Government, in consequence of a report made by the Committee of the Chemical Arts of the Society of Encouragement.

In 1783 a Company at Nantes formed an establishment for making sheets of zinc, intended for sheathing ships; but although this metal was not then suspected to have the property of oxydating by the decomposition of water, the use of it was abandoned after a few trials.

M. Buschaendorff, of Leipsic, published, in 1800, a process of tinning upon copper, which consisted in recharging a first coat of tin with a mixture of three parts of zinc and two of tin; of which he affirmed that he had made a solid and durable vessel.

An assayer of money at Vienna, M. Deiter, announced some years afterwards, that he had attained the art of forging with zinc boilers, cucurbites, and other utensils, to which he attributed the property of being less oxydable, and especially less deleterious than those of copper.

Nearly at the same time zinc was still more pompously recommended in England to supply the place of copper. They gave the honour to Messrs. Hobson and Sylvestre of the invention of the processes described several years before by M. Proust, for obtaining zinc pure and malleable. A M. Randale was mentioned as having tried for two years a covering made with sheets of this metal, which was fabricated in London, and was four feet long

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by two wide: they particularly recommended the use of it for water pipes.

If we except from these applications the coverings of roofs over which rain water passes, which is not destined to supply cisterns, and which in this case has some advantages, there is reason to believe that the proofs have fallen far short of these promises; we have at least no proof of general opinion in its favour, and we see that the most celebrated English chemists have not ceased to maintain that zinc is attacked by water, and that it forms metallic salts with the weakest vegetable acids.

In 1808 M. Tournar solicited the support of the Society of Encouragement to induce the Minister of the Interior to accept his offer of furnishing for the covering of a new public building, in the place of copper, a mixture of his own composition, which he believed to be equally suitable for sheathing ships, and for making the nails employed in their construction. He succeeded in 1784 in obtaining permission to employ this mixture in covering a part of the Corn Hall. The Committee, from the account given of the state in which the sheets of this mixture were taken off at the end of four years, did not think itself authorised to give its approbation without further experiments.

M. Proust, who in his large work upon tinning, published in 1804, shews himself more desirous of quieting than of augmenting the fears that are entertained respecting the use of our domestic utensils, does not conceal the facility with which zinc is attacked by the weakest acids, and concludes in these terms: *Zinc compared with tin, as a metal calculated to defend us from the ill effects of copper, has nothing to recommend it.*

We cannot see without surprise, that notwithstanding similar decisions since those of Macquer have always

been

been confirmed by the most celebrated chemists, there are still persons who propose our placing an entire confidence in this metal, for the purpose of preparing food; but the facility with which it is now known that it can be treated with the hammer, and the abundance of mines in the territory of the French empire, have excited the emulation of interested individuals, who have solicited Government to admit the products of their fabrication into large establishments.

Three reports have already been made by the Commission charged to examine the salubrity of vessels made of zinc; the first, by Messrs. Chaussier, Gay-Lussac, and Thenard, to the Minister of War; the second, by the Consultative Committee to the Minister of Manufactures and Commerce; the third, to the faculty, by Messrs. Vauquelin and Deyeux. The unanimous result is, that this metal cannot be used in preparing food without danger. We see in the last report, which is printed in the Bulletin of the Faculty, in 1812, that this metal is attacked by vinegar, lemon-juice, sorrel, neutral salts, even by common salt, and indeed by fat, to that degree, that one of the saucepans presented by Messrs. Dony and Montagnac was eaten into holes only from being used in the operation habitually practised in kitchens, of melting butter with a great degree of heat.

In consequence of reports so unequivocal, proceeding from the most enlightened characters, the question might, doubtless, be considered as irrevocably decided; yet the Committee still thought it their duty to make a further examination of some utensils transmitted to them by M. Perrott; the results of these experiments were as follows:

1st. Five decilities of *distilled water* were put into a saucepan, which was kept on a sand-bath, at a heat of

only

only 35 to 40 centigrade degrees, until the evaporation had reduced it to one-fourth of the quantity; the remainder being carefully poured out, when cooled; the saucepan was found to be in the state in which it was exhibited to the class; the bottom and surrounding part, as high as the sand-bath, covered with perfect *hydrate of zinc*, in which a metallic taste, slightly acid, was distinguishable.

2d. *Cold distilled vinegar;* which is known to be much weaker than that of commerce, and rendered still weaker by sixteen times as much distilled water, formed at the end of twelve hours a white stripe round the saucepan. When put for half an hour on the sand-bath this stripe was sensibly augmented. The liquor filtered and proved by prussiate of potash gave immediately an abundant white flaky precipitate. The addition of a solution of potash produced the same effect.

3d. A very weak solution of *cream of tartar* in distilled water, put cold into the saucepan, formed at the end of twelve hours a stripe of white saline matter; the liquor filtered yielded an abundant precipitate by the addition of prussiate of potash.

4th. A very thin plate of zinc, from M. Dony, put in digestion, cold, in a very weak solution of cream of tartar, afforded the same phenomena.

5th. A similar plate being kept for six hours in digestion cold, in *citric acid*, the liquor diluted with distilled water, and filtered, gave an abundant precipitate by the addition of potash.

TO BE CONCLUDED IN OUR NEXT.

List

List of Patents for Inventions, &c.

(Continued from Page 192.)

George Dunnage, of the Upper Mall, Hammersmith, in the county of Middlesex, Esquire; for a method of rowing or propelling boats, or any other vessels. Dated July 26, 1814.

Henry William Vanderkleft, of No. 253, High Holborn, in the County of Middlesex, Gentleman; for a method of purifying and refining Greenland whale and seal oil. Dated July 26, 1814.

Anthony Hill, of Plymouth Iron-works, in the county of Glamorgan, Ironmaster; for certain improvements in the melting and working of iron. Dated July 21, 1814.

William Johnson, of Hall Farm, Heybridge, in the county of Essex, Gentleman; for an improved process of making salt. Dated July 26, 1814.

William Doncaster, of Charles-street, Cavendish-square, in the county of Middlesex, Gentleman; for a series of improvements in the construction, uses, and mode, of navigating ships and other vessels of various denominations, in marine and inland navigation; and for abstracting such powers and machinery as form an hydrostator or mill; and also a mode and combination applicable to easing the draft and accelerating the motion of carriages travelling on land; and also a dining table upon an improved principle. Dated July 26, 1814.

Thomas Sykes, of Sheffield, in the county of York, Gunsmith and Manufacturer of Powder-flasks, Shot-belts, and other articles; for various improvements in the construction of guns, pistols, and other fire-arms; and of implements used for loading them. Dated August 4, 1814.

James

solidity or comparative dryness, when it will become necessary to extract it by force; and I ascertain the progress and approach to dryness of that solution by the inspection and examination of samples, which I from time to time take out of the evaporating vessel, with the instrument hereinafter described, for the like purpose. And forasmuch as a thermometer is liable to be broken by being exposed naked within the boiler, and it must nevertheless; be in as perfect contact as possible with the boiling sugar, I do by preference inclose the bulb, and such part of the neck thereof as is not required to be seen, in a metallic tube, by preference of iron, tinned externally, and screwed, soldered, or otherwise inserted, air-tight, into the boiler, and having the lower end thereof perfectly closed, and descending sufficiently low to be always immersed in the boiling sugar. And, in order to perfect the contact or communication between the metal of the said tube and the bulb of the thermometer, I pour as much mercury into the tube as will cover the said bulb. And, in order to take samples of the solution from time to time from the said boiler, for the purpose of making trials of the tenacity or other variable quality indicating the density or approach to dryness of such solution, or for any other purpose, without forming an immediate communication between the boiler and the external air, I do make and use a pipe, represented by 4, 4, 4, 4, in Fig. 5, (Plate XII.) hereunto annexed. And the said tube is inserted, in an inclined position, through the side of the said boiler, with the inner end thereof lowest (18, 18); and I do secure the joining or place of insertion (21, 21) by screwing, soldering, or by any other means which will keep the juncture sound and air-tight; and I do leave the outer extremity of the said tube open; and I do so dispose the inner end thereof as that

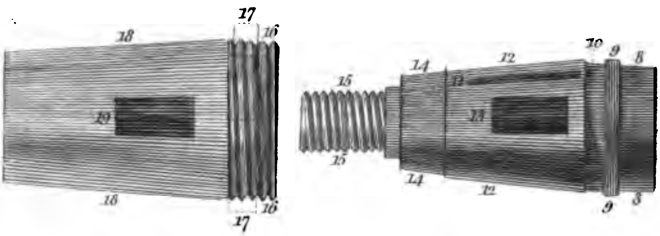


Fig. 2.

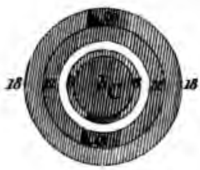
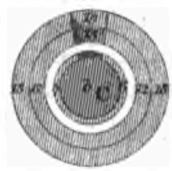
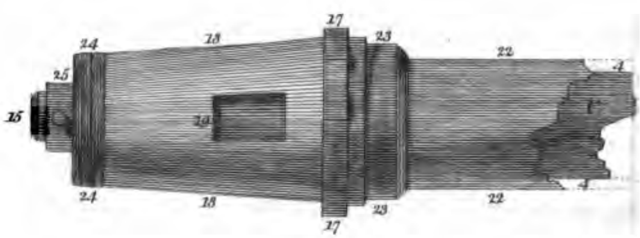
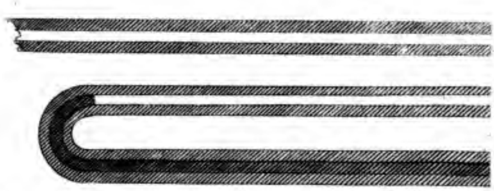


Fig. 3.







that the same shall be immersed in the saccharine solution; and I do close the said end, but I leave a slit or aperture (No. 19) in the upper side thereof, of at least half an inch in its smallest dimensions. And I do accurately fit within the said inner or lower end (18, 18) a short piece of tube, capable of moving by rotation, in the manner of the pin of a cock, (8 to 15, in Fig. 1,) but concentric with the other tube, and limited by stops or studs from revolving through more than about half a turn. And I do make in the said short piece a slit or aperture (13) to correspond with and afford a communication through the slit or aperture (19) in the tube so fixed as aforesaid, at such time as by the rotation of the said short piece both slits or apertures shall be placed opposite to, and communicating through, each other. (See the section Fig. 3.)

And, further, I do make a plug or piece to be put into, and nearly, but not precisely, to fill or fit the cavities or internal spaces 22 in Fig. 5, and 12 in Figs. 2, 3, 4, within the said tubes, and so formed or provided with notches, studs, or the like means, as to take hold of or become connected with, and, if required, to turn the said short tube whensoever the said plug or piece shall be thrust home to its place, or nearly so. (See the parts coloured blue in all the figures, and marked *c* in the plate.)

And, moreover, I do make an excavation or cell within the said plug or piece in the part thereof which is or may be opposite to the slit or aperture (13) in the short tube, when both the said tubes and the said plug or piece are or may be in connection as aforesaid, and communicating through the said slit or aperture, and in consequence hereof it will ensue, that whenever the respective slits or apertures in the said before-described tubes or pieces shall or may be made to correspond with, and af-

ford a communication through, each other; then the said excavation or cell will also communicate with, and become filled with, the saccharine solution, and the plug may be taken out. But, in order that no communication should take place with the external air whilst the said plug is turned round, or whilst the excavation thereof communicates with the said solution, I do accurately fit the said piece or plug within the said first-mentioned external tube by a conical portion of both (S S and *a a* at or near the external end of each).

And, further, in order that the motion of the short piece of tube may not be obstructed by the adhesion of the saccharine solution when become viscid and tenacious, I do make a groove or grooves (10, 11) on the surface of the said short piece, as practised in the axletrees of some carriages, and fill the same with a mixture of wax and grease.—17, 17 denotes a binding nut for setting fast the screw 16, 16. And the act or operation of charging the said plug or piece, and taking out a sample of the saccharine solution, is performed as follows: I thrust down or home the piece or plug, as shewn in the section Fig. 2, and turn the same to the position Fig. 3, in which the aperture of the cell or cavity (6) shall be uppermost, and consequently that cavity will become charged; and then turn the plug back to the situation shewn Fig. 2, which closes the communication through (19), and then withdraw the plug just sufficiently to disengage the same from the short tube; and this last-mentioned tube consequently remaining shut, I return the piece or plug to its former situation with the aperture of its cell or cavity uppermost, as shewn Fig. 4; and by withdrawing the plug with its cavity *b*, I do take thereout the sample required. But I hereby declare, that my invention, for which this present Patent is obtained, in so

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far as regards the last-mentioned improvements upon my former process, does consist in the evaporation or concentration of the saccharine solution by the application of heat to the said solution in a vacuum, and in the maintenance of the said vacuum by the continued action of a pump, or other exhausting instrument, although the common gauge should indicate no change. To which operation it is subservient, that I have herein pointed out a method of ascertaining from time to time the density of the said solution by comparative observations of the boiling point and pressure, without drawing off any of the said solution, although I have also shewn in what manner such portion of the solution may, if required, be conveniently drawn out by a particular instrument.

And, further, I do declare, that having brought the solution or liquid sugar, by due evaporation, to the density required for its intended purpose, I withdraw it, by a convenient and proper aperture, from the boiler into a granulating vessel, in the nature of that now commonly used as a cooler, which I construct or fit up capable of being heated, by preference with steam, applied to its external surface, or by other fit means. And I do therein so regulate the temperature of the said liquor, that it may undergo the requisite or usual stirring to effect granulation, and that it may be also sufficiently fluid and sufficiently cool to allow the particles thereof to arrange themselves in crystalline grains, to which I find they have the most tendency between the degrees of 150 and 160 of Fahrenheit, inclining to the one or the other in the ratio of the density of the said evaporated liquor. But since, in practice, this granulation is most advantageously accomplished by alternations of temperature above and below the said last-mentioned degrees, I do in preference, upon the said liquor being drawn off as aforesaid, heat up the same (as

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soon as it has acquired some grain) to about 180 degrees, and subsequently cool it to about 150 degrees, either by withdrawing the application of heat, and stirring out or allowing the escape thereof, or by the addition of a due quantity of colder evaporated liquor, as it has been usual to give heat by what is called skippings; or by both, or any other fit means; and I do again elevate the temperature as aforesaid; and I repeat and vary such alternations of temperature until the sugar has formed itself into the best grain of which it seems capable to the experienced workman, who may, after some practice in this my process, be able to judge by the eye of the best temperatures and fluidity, even without the use of any thermometer, although I do recommend its constant use. And when I apply heat to the said evaporated or granular liquor for the last time, I do by preference raise the same up to nearly 200 degrees, and not higher; and I do fill the moulds therewith, employing either those in common use or those directed in my said Specification, or those hereinafter described, for, in the event of its being required to retain the point of the lump, loaf, or mass, without returning the syrup contained in that point upon the body thereof, I do, as one of my said improvements, instead of employing a mould, with the appendage of a pipe, as described in the said Specification, employ moulds, purposely made of greater length than usual, in order that the point of the loaf, lump, or mass, to be in them contained, may have as much of its pointed end cut off as will not part with its syrup, which I accomplish by a revolving instrument, resembling a chuck in the art of turnery, and made concave, and provided with a side cutter within. And the said instrument is made to revolve by the mandril or axis of a turning-lathe, duly fitted up, and is of such a figure (nearly approaching that

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of a hollow cone) within as to take away that extraordinary length of point in which the syrup is chiefly lodged, and to leave the loaf of the regular length, and of the shape which may be required or preferred in the market. And I do use and apply the said instrument accordingly. And in all cases, not especially mentioned, I do proceed according to the practice of sugar-refinement as now used, subject to the directions herein, and in my Specification declared; but I hereby declare that my invention, for which this present Patent is obtained, in so far as regards the last-mentioned improvement upon my former process which relates to the granulation or crystalizing of sugar, does consist in substituting for the method of skippings, used in the ordinary process, and for the method in my former Specification mentioned, the application of different degrees of temperature alternately to the same mass of evaporated or concentrated saccharine liquor.

And, I do declare, that my said invention, taken collectively, does consist in the application and use of the methods herein before set forth, by which certain principles, or general facts, in part well-known, are brought into practice and effect in the process of manufacturing sugars; and that my said invention of the improvements aforesaid, and the several parts, manipulations, or proceedings thereof, may be carried into effect and practice, either wholly or separately, without conjunction, or in conjunction, with the methods of sugar-refining already in common use, or in the said Specification described and set forth. And that the management thereof, the several proportions of materials or ingredients, the furnaces, vessels, or apparatus to be used, and the needful attentions to local and other circumstances, are all susceptible of variation, according to the exigencies of the respective works,

works or operations; but that the same are either well known, or may with facility be made or adopted from the instructions contained in these presents, and in my said Specification before mentioned, by any competent workman, or other person or persons acquainted with the general course and nature of manufacturing works, and particularly with the present art of refining sugars.

In witness whereof, &c.

Specification of the Patent granted to HENRY WILLIAM VANDERKLEFT, *of High Holborn, in the County of Middlesex, Gentleman; for a Method of sweetening, purifying, and refining, Greenland, Whale, and Seal Oil.*

Dated July 26, 1814.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said Henry William Vanderkleft do hereby declare that the nature of my said invention, and the manner in which the same is to be performed, is described and ascertained in the following explanation thereof; that is to say: The oil, in its raw state, is filtered through bags, about forty-one inches long, with circular mouths, extended by a wooden hoop, about fifteen inches in diameter, fixed thereto. These bags are made of jean, lined with flannel; between which jean and flannel powdered charcoal is placed throughout, to a regular thickness, of about half an inch, for the purpose of retaining the glutinous particles of the oil, and straining it from impurities; and the bags are quilted, to prevent the charcoal from becoming thicker in one part than another, and to keep the linings more compact. The oil is pumped into a large funnel, made of tin, annexed to the pump through

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a perpendicular pipe, and passes from the funnel into another pipe placed over the bags horizontally, from whence it is introduced into them by cocks. The oil runs from the filtering bags into a cistern, about eight feet long by four feet broad and four and a half feet deep, made of wood, and lined with lead, and containing water at the bottom, about the depth of five or six inches, in which are dissolved about six ounces of blue vitriol, for the purpose of drawing down the glutinous and offensive particles of the oil which have escaped through the charcoal, and thereby rendering it clean and free from the unpleasant smell attendant upon the oil in the raw state: and, in order to enable the oil thus to run from the bags, they are hung in a frame or rack, made like a ladder, with the spokes or rails at sufficient distances to receive the hoop of the bag between two; and such frame or rack is placed in a horizontal position over the cistern. The oil is suffered to run into the cistern until it stands to the depth of about two feet in the water, and there to remain for three or four days, (according to the quality of the oil,) and is then drawn off by a cock, which is fixed in the cistern, a little above the water, into a tub or other vessel, when it will be found to be considerably purified and refined; and the oil, after having undergone this operation, may be rendered still more pure by passing a second or third time through similar bags and cisterns. But the oil, after such second and third process, is drawn off into, and filtered through, additional bags, made of jean, lined with flannel, inclosed in other bags, made of jean, doubled, when the process is compleat.

In witness whereof, &c.

Specification of the Patent granted to DANIEL GOODALL, *of Burton Latimer, in the County of Northampton, Crape-manufacturer; for manufacturing of English Crapes from Silks dyed and coloured, both before and after they are thrown or spun into Crape, Silk, or Silk for the manufacturing of Crape, and introducing weaving or working into the Warp and Shute of such Crapes, black, white, coloured, and fancy Silks, and also black, white, coloured, and fancy Cottons and Worsted, and also Gold and Silver, and every other Description of plain or fancy Materials.*

Dated March 12, 1814.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said Daniel Goodall do hereby declare that the nature of my said invention, and the manner in which the same is to be performed, are particularly described and ascertained in manner following; that is to say: Whereas, in the methods of manufacturing crapes, which have hitherto been made use of, the silk is hard twisted, and then woven into a gauze, and crimped and dressed without depriving the material of its natural gum in most fabrics or crapes which are to be plain black. And, whereas, with regard to crapes intended to be dyed of one uniform fancy colour, or left white, the practice has hitherto been to boil the goods with soap, or otherwise, subsequent to the weaving and crimping, by which means the silk becomes wholly, or almost wholly, deprived of its natural gum, and the crapes are thereby fit to be dyed in the piece by the usual methods. Now, instead of the said recited processes, I do, according to the colour intended to be given, and kind of goods (or patterns

patterns) intended to be produced, dye my silk, either in the skein, or after the same shall have been thrown or spun, but before the weaving, and either in the gum, or after the same shall have been deprived of so much of its gum by boiling with soap, or otherwise, as such intended colour and kind of goods (or patterns) may require. And as to the methods of boiling off and sulphuring my thrown or twisted silk which is intended either for white crapes, silk, or coloured crape silk, I cause the same to be in the first instance wound upon a reel, previous to the boiling off and sulphuring, (which is generally necessary as well for coloured as white crape silk,) in order to prevent the same from snarling, furling, or drawing itself together, as it otherwise would do; on which reel the same is boiled off and sulphured; and when the same is so boiled off and sulphured I cause the same, if intended for white crape silk, to be unwound from the same reel in that state upon bobbin, or drawn off into a warp or shute, in order to its being woven, and intended for coloured crape silk. I cause the same, after it has been so boiled off and sulphured, to be immersed in the dye upon reels, provided for each particular colour; and when the same shall have been so dyed, to be unwound from the said reel, and wound upon bobbin, or drawn off into a warp or shute, in order to its being woven. And I do, after such preparations as aforesaid, proceed to weave the said crape-silk, either in plain colours or in pattern, formed by different coloured silks in the warp or shute of the goods, either along with or without the admixture of threads of cotton, worsted, gold, and silver, or with or without any other description of plain or fancy materials, so as by such weaving and admixture to produce a great variety of patterns, according as choice or the demand

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of the consumer may determine, encourage, or require. And, lastly, I crimp, dress, or finish, the goods so wrought, manufactured, and made, pursuant to my said invention, by all and every or any of the methods or means now in general use for those purposes.

In witness whereof, &c.

Hydro-pneumatic Blow-Pipe, for the Use of Chemists, Enamellers, Assayers, and Glass-blowers.

By Mr. JOHN TILLEY, *of Whitechapel.*

With a Plate.

From the TRANSACTIONS of the SOCIETY for the Encouragement of ARTS, MANUFACTURES, and COMMERCE.

Fifteen Guineas were voted to Mr. TILLEY *for this Invention.*

BEING a travelling fancy glass-blower, I work with a machine which I have contrived for my own use, and which I have been advised, by a great number of respectable gentlemen, to lay before the Society of Arts, &c. The invention consists of a tin box, with a partition in it, reaching from the top at one end to within an inch of the bottom. The vessel is air-tight at this end. It is three parts filled with water. By means of a tube, reaching within half an inch of the bottom, I blow into the water, at the air-tight end; the air rises in bubbles through the water to the top, and forces the water under the partition into the other compartment. The weight of the water acts upon the air which had been blown in, and forces it through a blow-pipe directed to the lamp, and keeps up

up a continued blast till the air is exhausted. More air may be blown in from time to time, so as to keep the blast regular and continual. It is thus I execute my fancy glass-blowing. The whole apparatus, including lamp and case, weighs only three pounds and a half.

I believe I am the first glass-blower who ever worked with such a machine.

The apparatus is applicable to the business of enamellers, jewellers, chemists, and many other arts, and can be furnished complete for 2*l.* 12*s.* 6*d.* made of tinned copper.

Reference to the Engravings.

The utility of the blow-pipe, in the arts, to raise a great heat in a small object, from the flame of a lamp, is too well known to require pointing out. The assay of minerals, the arts of enamelling, jewellery, soldering metal works, but, above all, the blowing of small articles in glass, are purposes to which it is better adapted than almost any other mode of applying heat. The usual manner of producing a stream of air for blowing glass, is by means of a small pair of double-acting bellows, fixed beneath a table, and worked by the operator's foot; a pipe proceeds from these bellows to the top of the table, and terminates in a small jet, before which a lamp is placed, and the flame blown by the current of air upon the object to be heated. The defects of the bellows are, that the stream of air is not perfectly regular, which causes a wavering of the flame, so that it does not fall steadily upon the object which is to be heated. Mr. Tilley's blow-pipe corrects these defects, by using the pressure of a column of water to regulate the stream of air, and the supply is

furnished from the mouth of the operator, by blowing through a tube, Fig. 2, (Plate XIII.) C, at a section of this instrument, and Fig. 3 shews a perspective view of it in action. A A, is a vessel of tinned iron, or copper, about seventeen inches high, five wide, and nine broad; the lid of which opens and shuts on hinges, and supports the lamp B, which burns tallow instead of oil. C, is the blowing-pipe, by which the air is thrown into the vessel; this, as shewn in the section, Fig. 2, has an inclined partition D, which divides it into two chambers, E and F; but as the partition does not reach to the bottom of the vessel, the two compartments communicate with each other underneath it; that marked F is closed at the top, so as to be air-tight; but the other is only covered by the lid of the vessel, and may therefore be considered as being open to the outward air. The pipe C, Fig. 2, is soldered air-tight, where it passes through the top of the chamber, and descends very near to the bottom of the vessel, deeper than the partition D does, so that its mouth is always immersed beneath the water. The metallic part of the blow-pipe G, which conveys the blast of air to the flame of the lamp, is likewise soldered into the top of the chamber F, it holds a bent glass tube *a*, which terminates in a very small and delicate jet, and is fitted air-tight into the tin or copper tube G. Now, by blowing into the tube C, the air is forced out at the bottom of it, and rises in bubbles through the water into the upper part of the chamber F; this displaces a corresponding quantity of water, which passes under the partition D into the other chamber E, elevating the surface of the column of water, and depressing the other, as shewn in the figure; the water endeavouring to return to its original level, causes a constant compressure of the air, and

forces

forces it through the jet *a* into the flame of the lamp. By this means it is not necessary to blow constantly with the mouth; for though the air is forced into the receiver at intervals, yet the pressure of the water will expel it in a constant stream, and the operator will not be fatigued by the motion of the foot necessary in working bellows, nor need even to keep his mouth at the pipe constantly, but merely to blow, from time to time, as he finds the stream of air to decrease in its power.

The metal socket which connects the glass tube or blow-pipe *a* with the vessel A is made conical, and the tube, having a piece of paper first wrapped round it, is bound round with cotton-wick yarn in a conical form, so as to fit the socket tight, and yet permit the tube to be moved in any required direction, to cause the air to act properly upon the flame; and the curved metal tube C is also fixed into the upper part of the tube C in the same manner. H H are the two sides of a tin frame, which is fixed in front of the vessel, and has grooves withinside of them to receive a tin plate I, which forms a screen, and can be adjusted in height so as to keep the light of the lamp from the operator's eyes, though he can see the work over the top of it: this screen is held fast by its foot being placed between the lid of the vessel and the top of the close chamber F. K is one of two handles which support the operator's arms whilst holding a glass tube or other matter in the flame; and there is another like it at the opposite side of the vessel: these handles are also wrapped round with woollen-list or leather, so as to form cushions; and the vessel is steadily fixed upon a chair, bench, &c. by means of a leather strap buckled to the loops on each side of it, and passing under the chair, &c.

The

The lamp is made of tin, is of an elliptical, or rather of a bean or kidney shape, one side being carved inwards; across the centre of it stands a metal wick-holder, having a loop on one side of it, and which is soldered to its bottom. (See *r*, Fig. 4.) Through this loop the wick of cotton is drawn, and being opened both ways, as shewn in that figure, and still plainer in Fig. 6, forms a passage in its middle, through which the current of air from the jet *a* passes, as in Figs. 2 and 6, and carries the long-pointed flame upon the object to be heated. The lamp, Figs. 4 and 6, is filled with tallow, which, melting by the heat, becomes fluid, and burns as well as oil, but with a less offensive smell, and when cold, being solid, is more conveniently carried than oil. This lamp is placed within another vessel marked B, Figs. 2, 3, and 6, which supports it at a proper height, leaving a space between them all round, to receive any tallow which may run over the edge of the interior vessel or lamp.

In using this blow-pipe, the following observations being attended to, will greatly increase its effect. The long flat cotton wick of the lamp will be found to act better than the usual round cotton wick; but in either case the flame which it raises will be considerable. The end of the glass pipe *a* must be just entered into the flame, and the current of air will throw out a cone of flame from the opposite side. If it is well managed, this cone will be distinct and well defined, and extend to a considerable length. Care must be taken, that the stream of air does not strike against any part of the wick, as it would then be disturbed, and the cone split into several parts. (A wire bent at its end, as shewn at Fig. 5, is very convenient to smooth the passage through the wick.) The jet of air must be delivered somewhat above the wick; and as, unless

unless the flame was considerable, there would not be sufficient for the steam of air to act upon, for this reason the wick is opened, as shewn in Fig. 4, that it may expose the larger surface, and produce the greatest flame: the stream of air from the pipe should be directed through the channel or opening between the wick, so as to produce a cone the most perfect and brilliant. On examining this cone of flame, it appears to be formed of two different colours, the part nearest to the lamp being of a yellowish white, and that beyond of blue or purple colour.

The subject which is to heated is held in the flame at the termination of the yellowish-white flame, where it receives the greatest heat, and is not discoloured by the soot, which accompanies the white flame.

Glass tubes are, when applied to this flame, quickly rendered pliable, and may be bent or drawn out into threads or points, and hermetically sealed; or, by blowing into the other end of the tube, it may be expanded into a small globe, so as to form various small articles at the pleasure of the operator.

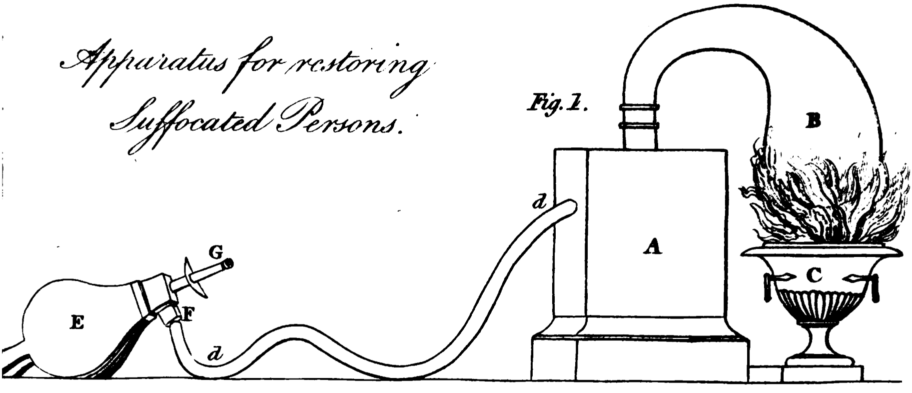
In chemistry, mineralogy, and the arts, the blow-pipe is an extremely useful instrument, being capable of throwing such a powerful heat on a small object, as would be difficult to obtain on a larger quantity of the same substance, in the most powerful furnaces: and with this advantage, that the process is always under the inspection of the operator; whereas he can only conjecture what passes in the centre of a furnace.

In using the blow-pipe for experiment, a piece of charcoal is generally used to support the subject, and held in the flame of the lamp; the charcoal should be of a close compact grain, and properly burnt; for if it is too little

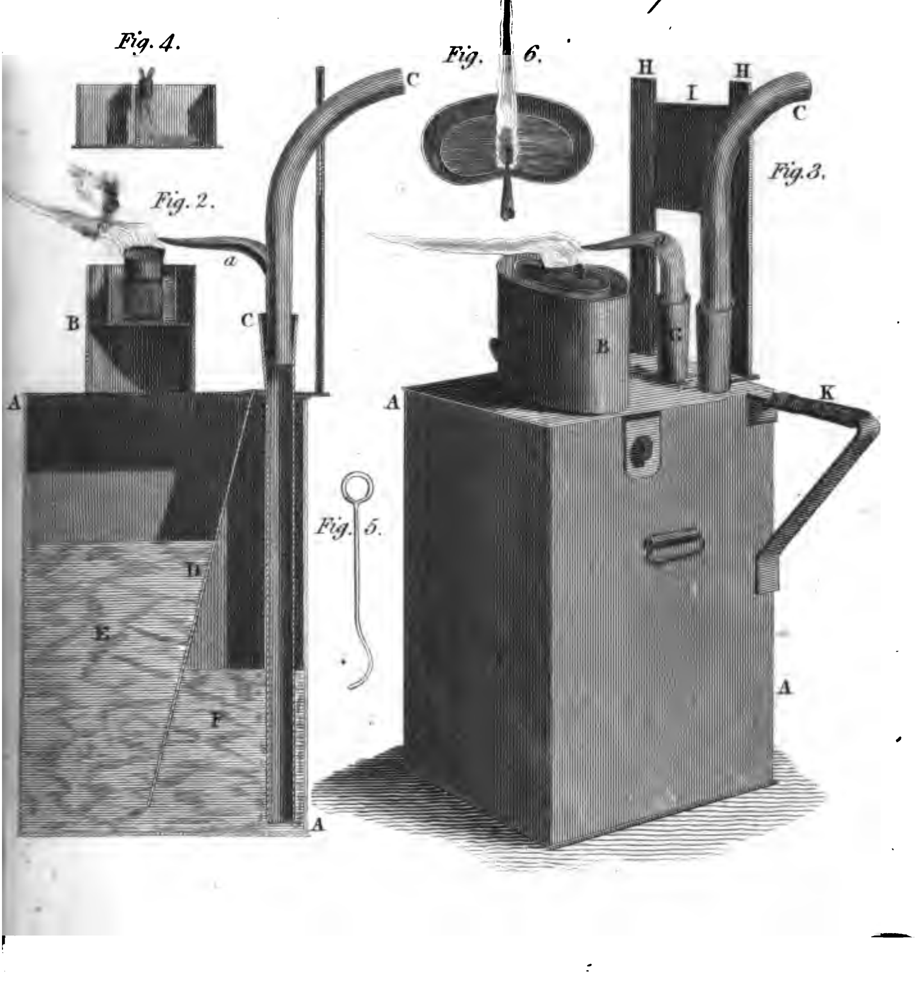
little carbonised it will flame like a piece of wood, and obscure the object; and if it is too much burnt, it is so quickly consumed, and burnt to ashes, that the object is in danger of being lost in it; the charcoal greatly increases the heat by reverberating the flame, and by heating the object at the opposite side; itself being converted into fuel, and excited by the blast, and thus creates an atmosphere of flame and heated air around it, which prevents the heat being carried off so fast, or the object being so much cooled, as if it should for an instant be moved out of the cone of the flame, from the unsteadiness of the hand, or from accidental currents of air, which would disturb the flame, and cause such a wavering in the point of the cone as to divert it in some measure from the object. In order to prevent more tallow than is necessary from being consumed, to produce the intended effect, it is convenient to have several lamps, with wicks of different thicknesses, *viz.* one to hold two flat cottons, (such as are used for the Liverpool lamps,) of about one inch and a quarter broad, another to hold four, and a third to hold six, or as much common wick yarn as is equal to those wicks in bulk; glass jets should also be provided of different sized apertures, to suit the greater or lesser sized wicks and flames, and deliver streams of air upon them proportionately, and their jets should point upwards in a small degree; hogslard is also equal, or perhaps superior, to tallow for the lamp.

On

Apparatus for restoring Suffocated Persons.



Pneumatic Blow Pipe.



On the Construction of the Flues of Hot-houses. In a Letter from C. Lorimer, Esq. to Dr. Duncan.

From the Transactions of the Caledonian Horticultural Society.

Mr. Burnet, of Viewfield, (a particular friend of mine,) was the inventor of can-flues. He built a hot-house for vines about four years ago, thirty-five feet long by thirteen feet wide, (inside measure,) with one furnace, which he finds fully sufficient to keep up a proper temperature in the coldest weather. He then consulted me respecting his plan for the flues, and the only credit I can take in the business, was my giving him my decided opinion, that it would completely answer his most sanguine expectations. He followed my advice at the time, and he has since had the largest crops of grapes I ever saw upon vines of the same age; and for the two last years every part of his house, from the bottom to the top, has been loaded with a profusion of fine clusters, so thick, that they appeared every where almost touching one another. From the observations he has made, he informs me, that after the eyes of his vines are all fairly broke in the Spring, and he was at liberty to increase the heat in the hot-house, he commonly found the thermometer, at eight or nine o'clock in the evening, to stand from 72° to 75°. The fire was then mended for the night; and the succeeding morning (about six o'clock) the thermometer kept up within two, or at most three degrees of what it was the night before. His furnace is built after Mr. Nicol's plan, with Rumford-doors; and when the fire is mended for the night he shuts his ash-pit-door quite close, which prevents the heat being too much increased, and occasions a very small consumption of fuel; yet, from the

the cans being so thin, a proper degree of heat is transmitted to forward the growth of the vines amazingly fast.

I have two small hot-houses for vines, with one of Mr. Nicol or Mr. Loudon's furnaces to each. One of these houses has a flue built with bricks, and tile covers, in the old construction. The flue of the other was taken down about three years since, and a can-flue put in its place, which I consider a real improvement. In 1809 I put fire to the first-mentioned house, the 14th February, and the other had no fire till the 30th March following; yet the house with the can-flue ripened the grapes sooner than the other, which was fired six weeks earlier, and with a considerable saving of fuel.

This year, 1810, I repeated the experiment, and the result was the same. The house with the can-flue has ripened the grapes in six weeks less time than the one with the flue of the old construction.

In case you shall consider the particulars above mentioned of sufficient importance to be communicated to the Caledonian Horticultural Society, I shall take the liberty of mentioning the size of the cans used in Mr. Burnet's hot-house and mine. They are from twenty-five to twenty-six inches long, of a conical or taper shape, from thirteen to thirteen and one-half inches in diameter at the large end, and from eleven to eleven one-half inches at the small end (inside measure). When they are laid for a flue the small end is inserted into the large one an inch, or an inch and a half, and the joinings closed with lime-plaster. I at first used fire-clay, but it cracked and fell off, and the smoke got into the house; but since I used the lime-plaster the flue has been perfectly tight, and the house free from smoke.

Perhaps it might be an improvement if the cans were made

made of a cylindrical or drum shape, all of the same diameter, so that the ends would exactly fit one another, with about the half of the thickness of the cans taken off the outside for three-fourths of an inch from each end to hold the plaster. This would make the flue look much better on the outside, the swelling at the joinings from the plaster being thereby greatly reduced, and when the flue is cleaned the soot would be easier got out, as it would be quite smooth in the inside from end to end.

It may be objected, that the hot-house will not have so much steam from the can-flues as from the flues of the old construction; but this will be found not to be the case. I have raised full as much steam, by sprinkling the cans with a watering-pan, (after they are sufficiently heated,) as ever I could do with flues of the old construction.

Mr. Burnet's cans are made of common clay, yet they have stood the heat very well; and though his flue one night had taken fire, only the can next the furnace was cracked. Mine are made of fire-clay, which I think safer; the strongest fire I have applied not having in the least injured them.

Mr. Carnegie, at East Linton, built a vinery in 1808, and adopted the can-flue, with which he is highly satisfied; and this season he has a large crop of grapes.

From the cans not being half an inch thick, it is evident they must transmit the heat sooner, and in much greater proportion, than flues of the old consruction; which are commonly three inches thick in the sides, and one inch in the tile-cover at the top.

When the can-flues are laid, the ends of the cans should rest upon a brick set on edge, which keeps the under part of the flue five inches from the ground, and thereby none of the heat is lost.

It may be also objected to the can-flues, that they will cool sooner than the brick and tile ones; but so long as any fire remains in the furnace the can-flues will transmit the heat, which is not the case with the old flues, when the fire becomes weak.

On a new Method of planting Asparagus.

By Mr. James Smith, *Gardener to the Earl of Kintore, at Keith-Hall, Aberdeenshire.*

From the Transactions of the Caledonian Horticultural Society.

IN April, 1807, I sowed some drills of asparagus seeds, which succeeded very well. I had intended to let the plants stand two years in the seed-rows; but in the third week in June, 1808, in preparing a piece of ground for a late crop of peas, it occurred, (owing to my having been often unsuccessful in the planting of asparagus in Spring,) to try a drill of it at this uncommon season. At one side of this piece of ground, therefore, I prepared a small stripe, with plenty of rotten dung, which was dug in to the depth of eighteen inches, and carefully mixed to the surface. In a drill, four or five inches deep, I planted my asparagus, at that time twelve or fifteen inches high, at three inches apart; keeping the tops perfectly upright, and breaking or hurting the roots as little as possible. They were covered in with the spade, gently trod with the foot, and a good watering finished the operation.

Although no particular care was taken to keep the earth about the roots of the plants at the time of taking them up, I hardly perceived them to flag, or sit up in their growth a single day. I am certain that none of them

died;

died; and they surpassed, in the course of the summer, the plants that were left in the seed-rows.

The following winter I put the whole piece of ground in preparation for the remainder of the seedlings, and about the end of March I planted them in drills four feet asunder, and three inches in the drill; but although due attention was paid to them in every respect, not one-half of them came forward; while those that were planted the preceding June were making such progress that I could have cut some of them for use.

The piece of ground consists of a thin gravelly soil, with a large proportion of peat-moss in it, (perhaps two-thirds,) having been the foundation of an old peat-stack.

Note by Mr. Nicol, *Secretary to the Society.*

I can vouch for the corractness of this communication, having seen the asparagus in question. I wrote Mr. Smith in December last, requesting a statement of the matter, in the shape of a communication to the Society.

Leith Walk, 2d March, 1810. W. N.

On Gooseberry Caterpillars, and Maggots that infest Onions. *By Mr.* John Macmurray, *Nurseryman.*

From the Transactions of the Caledonian Horticultural Society.

OBSERVING that the Caledonian Horticultural Society has requested information respecting "the best method of preventing or destroying the caterpillar on gooseberries," I beg leave to submit some observations on the former of these subjects; for prevention is certainly

tainly better than cure. I may premise, that my observations are founded on actual experience.

I shall first mention a preventive of a very simple kind, but which I have found efficacious.

In Autumn, let a quantity of *cow-urine* be provided; and let a little be poured around the stem of each bush, as much as suffices merely to moisten the ground. This simple expedient has succeeded to admiration; and its prophylactic virtues have seemed to extend to two successive years. The bushes which were treated in this manner remained free of caterpillars; while those that were neglected, or intentionally passed over, in the same compartments, were totally destroyed by the depredations of the insects.

I have next to state another mode of prevention, equally simple, and equally efficacious; but the salutary effects of which extend only to the season immediately following the application.

Collect as much drift *sea-weed* from the beach, when opportunity occurs, as will cover the gooseberry compartment to the depth of four or five inches. Lay it on in Autumn. Let this covering remain untouched during the Winter and early Spring months. As the season advances dig it in. This plan has answered my most sanguine expectations; no caterpillars ever infesting the compartments treated with sea-weed.

The *rationale* of the operation of these substances, when applied to the soil around the roots of gooseberry-bushes, I leave to speculative inquirers.

I am rather uncertain as to the particular species of caterpillar which commits the greatest ravages on the gooseberry-bush. Two species very generally occur; the Linnean names of the moths produced from which, are, *Phalæna Wavaria*, and *Ph. Grossulariata.* My own experience

perience would lead me to conclude, that the first of these species is the most common and the most destructive.

Though it would appear, from the observations of naturalists, that not a few lepidopterous insects pass the chilly months of winter in the pupa state; yet an equal number lie concealed in the egg, which has been carefully deposited by the parent insect, where the genial influence of the sun will early call the caterpillar into action. A number of caterpillars, however, also retire into the earth, and remain there, in the pupa state, until the return of Spring excites to new changes and exertions.

What has now been stated seems to render it probable, that the beneficial effects derived from covering the gooseberry compartment with sea-weed, may depend on the strong effluvia arising from the putrefactive fermentation of the sea-weed, proving destructive to the ova of the moth which may remain imbedded in any crevices of the bark near the root; or on the saline properties of that substance sinking into the earth, and hindering the fertility of the ova deposited there.

I observe, that information is also wanted concerning the *Maggot in Onions.*—This animal may, in my opinion, be considered as a non-descript, and peculiar to the onion and shallot. The Allium Cepa, or onion, is a native of Spain. It is natural to expect, that the soil and climate of this country should not be very congenial to this plant; and it follows, that the value and quality of our crops of onions must always, in a great measure, depend on favourable seasons, and the selection of a suitable soil.

If the season be dry and parching, and the soil of itself incapable of supplying the fibres with a proper and equable degree of nourishment, the plant becomes languid, assumes a sickly hue, and generally dies.

When,

When, on the other hand, the season is very rainy, I am inclined to believe that the fibres get clogged with moisture, and the vegetable not being able to absorb it, it centres about the bulb; mouldiness succeeds to damp, and produces an ulceration which works its way to the inner core. This, of course, effectually destroys the onion.

I have always remarked, that whenever the onion becomes diseased it is liable to the attack of the maggot.

I could never detect this maggot in the soil: it is, therefore, highly probable, that the eggs are deposited in the root, and may be hatched in greatest numbers when the plant is in a sickly state. I do not think that the maggot ever passes from one onion to another. And any remedy sufficiently powerful to destroy the insect must inevitably destroy the onion itself.

In these circumstances, the horticulturist perhaps does all that is in his power, if he be duly careful to select for his crop of onions those soils and situations that are most likely to resist the various common incidents of season, peculiar to this very variable climate, and containing such eligible food, and in such proportions, as this bulbous esculent requires.

The maggot which attacks the carrot, I may remark, is certainly to be found in the soil, and visibly enters from without.

I conclude, for the present, with observing, that worms and insects in general are driven from their retreats under ground by pouring bitter or acrid water upon it—such as water in which green walnuts have been steeped, or a ley made from pctashes.

On

On destroying the Caterpillars infesting Fruit Trees. *By Mr.* Edward Sang, *Nurseryman.*

From the Transactions of the Caledonian Horticultural Society.

FOR the first seven years after the planting of my fruit trees on Loanwells garden-walls they made a most promising progress. But after this period they became by degrees overrun with caterpillars, chiefly, I believe, of *phalæna asperana,* which regularly made their appearance at the time of leafing.

The leaves were rolled up, and cemented with a glutinous substance; the caterpillar was lodged in the heart of the leaf, rolled up in a kind of imperfect cobweb, something like spiders work; and in this manner committed wonderful depredations.

Many of the buds never expanded, especially the fruit-buds, which having produced the foot-stalk of the young apple, the corolla never opened: it held the larva within it, which generally ate a hole down through the heart of the expected fruit, and so completed its destruction.

Year after year, even so late as the first or second week of June, many of my wall trees exhibited an appearance more like January than Midsummer. After the depredations of the caterpillars were over, and when these had entered the chrysalis state, the trees made vigorous efforts to supply what had been destroyed, and generally produced a great profusion of breast-wood. The circumstance arose in some measure from the moths, as they came out, choosing in preference to deposit their eggs in the flower-buds.

In Spring, 1805, I had recourse to fresh water, which

I threw upon the trees with as much violence as a hand force-pump was capable of; but from the worm being rolled up in the blossoms, it was defended from moisture, which otherwise seems destructive to it, I did little or no good by this application.

In Spring, 1806, I attempted their destruction by soot. After having wetted the trees, by means of a force-pump, I applied the soot with a bellows, containing it in a hopper, attached to the pipe, with proper holes in the upper part. By this instrument I had the soot properly applied; and I flattered myself that I now had hit upon the means of destroying the caterpillar completely: but I found myself again disappointed.

After a great deal of trouble, and much expense, my trees still wore a sickly appearance, excepting that the breast-wood was always abundant. I now found my difficulties increased, my trees rendered unfruitful, and yet producing a profusion of fore-right shoots.

I had formerly experienced the good effects of cutting the roots of fruit-trees, which were too luxuriant in their growth, and had one of the trees laid open for this operation in the season 1807-8. The roots were large, but with few fibres: I found it necessary to shorten them, not only to stop the rambling growth complained of above, but to furnish the tree with proper feeders, in order to render it fruitful, in case of getting the better of the caterpillar. In this operation I observed, upon examination, that the soil was deficient of a proper quantity of animal substance. I consequently set about making up this deficiency.

In 1807 and 1808 fodder was very scarce, and many old horses killed. I availed myself of this circumstance, and collected all the dead horses I could procure in the neigh-

neighbourhood, and I soon found myself master of above twenty carcases. I had the trees on my East and South aspects, treated as follows: A circular trench was made, about three feet distant from the trunk, and so deep as to cut every root through: into this trench was put half a horse at least, divided into proper pieces, and covered up. The following Spring, however, the caterpillars were not in the least diminished.

In Spring, 1809, I resorted to tobacco-liquor, and I found every worm which it could get at with the force-pump destroyed; but they are so well protected from any liquid, that but little was done in this way towards their destruction *.

Owing to the severe treatment above described, and the depredations of the caterpillars, no fruit was produced: my trees, however, looked quite green and healthy.

In August and September I found the moths very numerous, flying about my trees; I was certain, that they must deposit their eggs at this season, because at no other do they exist. Certain also of their being deposited upon or in the fruit and wood buds, I thought, if a proper liquor could be procured, sufficiently pungent and deleterious to kill them, and not to injure the trees, I might yet have a crop of fruit. Cheered with the hope of having a reward, for seventeen years application, I set about this last operation with alacrity.

In the beginning of January last, 1810, I took five pounds of flowers of sulphur, three pounds of soft soap, one pound of potash, four pints of very strong tobacco-

* The result of the experiments with the tobacco-liquor was communicated to Mr. Walter Nicol, in a letter dated the 29th November 1809, which has been since published by him in his "Garden Directory, and Gardener's Kalendar."

 liquor,

liquor, (the expense of all which is but trifling), and made up the mixture to ten pints, with fresh water: I put the mixture on the fire in a pot, and, when as intimately mixed as possible, I applied it, in a luke-warm state, with a small painter's brush, so as not to miss a single bud; and potful after potful was mixed up, till I had washed thirty-four full grown wall trees, apple, pear, and cherry. Several trees, which had been dressed with horse flesh as above, were left unbrushed, that they might be compared with those which had been washed.

This application has at last proved successful: and now, on the first of June, I must say, that no money that I ever laid out yielded me so much pleasure, nor gave me such a prospect of profit. My trees, which had for many years exhibited an appearance of barrenness, are now full of most healthy well-spread flowers, the stamina with fine antheræ upon them, quite bold; not a single apple tree on the whole wall so washed being barren, and the cherries and pears set quite thick.

I have had visits from a number of professional men this Spring, who have expressed their admiration of the trees so treated. It is proper to add, that those which were left unwashed are nearly as usual, full of caterpillars, which I fear will resist my utmost efforts to reduce them at this season. I have applied tobacco-liquor in its strongest state: it has had a good effect, but still the power that they have to resist every liquid remains as an insuperable bar to their entire destruction, unless it be applied with a brush.

I used twenty-five pounds of sulphur, and a corresponding quantity of the other ingredients, for thirty-four trees. The soap and tobacco liquor gave a tenacity to the mixture so as to hold the particles of sulphur apart, while

while the potash penetrates deep into the buds and bark, and destroys the eggs which produce the worm, and consequently destroys the glutinous matter which prevents the leaves and flowers from expanding.

I attribute the present healthy appearance of my trees entirely to the above application. The cutting of the roots has thrown them into a profusion of flowers, while the wash has destroyed the destroyers of my fruit and trees. I am, therefore, fully satisfied of the excellence of this wash; and must say, that I never saw any thing applied to fruit trees nearly so effectual for destroying this kind of caterpillars.

Another good effect of the wash may be stated. Six of the apple trees mentioned have been for the last eleven years much injured by mildew; but at this time there is hardly an infected leaf to be seen.

On the Culture of Onions, and particularly on the Advantages to be derived by transplanting them from a Seed-bed into regular Rows, at a proper Distance from each other. By Mr. James Macdonald, *Gardener to His Grace the Duke of Buccleuch and Queensberry, Dalkeith.*

From the Transactions of the Caledonian Horticultural Society.

THE onion, a well-known root, is in this country in common use among persons of almost every description; and, on that account, every improvement upon the culture of it may be considered as a matter of some consequence. From this consideration, I think it may not be improper to communicate to the Horticultural Society some observations on this subject. The method which I am to recommend is not merely speculative; for I have employed

employed it with manifest advantage during four successive years; and have found, from experience, that it not only produces excellent onions, but effectually prevents any destruction of the root, either by worms or by rot.

As the ground which I cultivate in the way of garden is a light thin soil, it is not so favourable for the production of onions as many other soils. This led me to make many different experiments; and I am happy to say, that I found the following method far exceed my most sanguine expectations.

In the end of February, 1808, I sowed my general crops of onions; and in each *break* I left one bed unsown. I pointed over the empty beds, and then drew in each bed, which was four feet and a half in breadth, six small drills. I then thinned out my young onion plants, and having prepared puddle, consisting of one part of soot and three parts of earth, mixed with a sufficient quantity of water, I took the young plants, and dipt the whole of the roots in this puddle. I then transplanted them into the drills, at the distance of four or five inches from each other. A moist day is preferable for this work; and when that is the case the vegetation seems to be in no degree retarded by their being moved. Nothing farther is afterwards wanted but to keep the beds free from weeds, by hoeing with a small hoe between the rows as soon as weeds appear.

Proper hoeing seems to promote the growth of the onions; and, by the end of August or September, those treated in this manner will far exceed those which are not transplanted, both in quality and in size. I also found them entirely free both from worm and from rot, while those which were left in the seed-bed were a good deal infested in both these ways.

In

In the end of January 1809 I again sowed my onion crops, making a still greater reserve of ground by interlining the beds, sowing one, and leaving another unsown.

In April I pointed over the empty beds, and transplanted the onions in the same manner as formerly mentioned. This trial was attended with equal success. The crops of transplanted onions far exceeded the others, both in quality and size.

In the beginning of March, 1810, I again sowed my onion crops, leaving a still greater reserve of grond for transplanting, nearly a quarter of an acre. This trial was attended with equal success as the two former ones. In the transplanted onions there was not the least appearance of worm or rot; and they swelled at least one-half larger than those which were not transplanted. Indeed, they were equal in size to the best Spanish onions; heavier for their bulk, and firmer. They had also a more pungent taste than is in general observed in Spanish onions.

The seeds employed were those most commonly used about Edinburgh; chiefly the Strasburg and Reading onion. All the kinds employed succeeded equally well when transplanted.

After these repeated trials, I have no doubt that the cultivation of onions by transplanting is an important improvement, and will be beneficial to the community. It will, I am convinced, be attended with less expense, and more profit, than the ordinary mode of culture. The transplanting may be performed by boys or girls, who will do as much of this work as any man can do in the same time, and at much lower wages. This method has the advantage of being cleared of weeds by hoeing in place

place of hand-weeding, which is in every respect much more beneficial to the growth of the plants. Besides this, a few beds of thick-sown onions may furnish plants for as many acres. The ground to be planted may be under Winter or Spring crops, and it will be sufficient to clear it of these by the end of April or the beginning of May, when the transplanting is to take place. Those growing in the seed-beds will in the mean time afford the necessary supply either for the family or market.

The advantages of this mode of cultivating onions, like many other things in gardening, requires only practice and perseverance to afford conviction to every one. And, I am happy to say, that many practical and amateur gardeners, who have seen the crops in Dalkeith Park, are fully convinced of these advantages; and I take this opportunity of presenting to the Caledonian Horticultural Society a few of my onions, as a sample of the general size.

Note.—The onions alluded to in the preceding paper, sent by Mr. Macdonald, were much admired by all the Members who were present at the meeting.

The Committee for Prizes unanimously voted to Mr. Macdonald an extra medal for this communication; and it was thought advisable that it should be printed in the first Number of the Memoirs, that every gardener may have it in his power to try the mode of cultivation which he has recommended during the ensuing season. It will give much satisfaction to the Society if those who make trials will communicate the result to Mr. Neill, Secretary.

On

Method of preserving Potatoes. By M. Parmentier.

From the Annales des Arts et Manufactures.

POTATOES are not difficult to preserve in small quantities, because they can with little trouble, and at no expense, be transported from the pit to the barn, from the outhouses to the cellars, according to the temperature. But large stores require other methods of preservation, although they will not allow of deviation from general rules, which require that they should always be collected in heaps, of from two to three feet thick at the most, that all the heaps shonld be separated, and preserved from the influence of light, of moist, heat, and of cold.

The quantity of water contained in potatoes, and their extreme tendency to germinate, hardly permits them to be long preserved after the period of plantation, whatever may be the process employed, in order to replace one harvest by another.

The best method of preserving them is to boil them a few times in water, or to wash, pare, and cut them into slices; to spread them upon hurdles of osier, and expose them to the heat of a stove, heated to 30 degrees of Reaumur, or to put them into an oven after bread has been baked in it. They lose in less than twenty-four hours three-fourths of their weight, acquire the transparency, the dryness, and hardness of horn, break clean, and the fracture shews them to be in a vitreous state.

Wherever they may be deposited in this state, they remain without undergoing any change. When they are wanted they may be sent to the mill, and the flour produced from them will be fit for use. It is a yellowish powder, similar to gum arabic, whlch dissolves in the mouth,

mouth, and communicates to water a mucous consistency, and the taste of dressed potatoes.

Another method of preserving and extending the use of potatoes, and of employing them to advantage, when they are worth little in substance, is to extract the fecula, provided they be neither dressed nor dried, nor changed to a certain degree.

The method which M. Parmentier has employed for this purpose, during fifty years, is to divide the potatoes by rasping or grating; by this method their aggregation is destroyed, the net work of the fibres is torn, and the vascular tissue is broken, to force out the water and fecula inclosed in them. Instead of fixing the grater to a frame, it may be fastened to a mill-stone, which greatly abridges the labour; it might be improved by adapting a fly-wheel to it, in order to regulate the motion, and facilitate the play. This mill dispatches forty-eight bushels of potatoes, and twelve workmen can make 120 pounds of fecula*; which is proved by experiment to be the same as starch.

It is true that this fecula is the most nutritious part of the potatoes, but it only represents one-fifth of their weight.

The fibrous part may be preserved by inclosing the grater in a linen bag, and pressing it afterwards. The dregs remaining, separated into small parcels, and exposed in an airy place, become friable, and fit to be used in cookery.

All the processes for drying potatoes have no other end than to render them fit to be made into bread. It has been thought that, in this dry state, they are more approximating to flour, that they mix better, are more easy to knead, and are more susceptible of absorbing the water in the oven during the baking; but the flour of pota-

* No time is stated in the French account.

toes,

toes, tried in different ways, in the proportion of a third or a fourth, renders even wheat bread heavy, and close as the purest starch, and the whitest rice flour.

The author concludes, that as we have now a mode of employing potatoes dressed, or reduced to a pulp, dried and brought to the state of flour, in the preparation of leguminous soups, jointly with barley and leguminous seeds, it only remains to augment their culture, in order that they may be used during a part of the year in the place of wheaten bread, without waiting even the season, when the potatoe threatens to grow. A certain number of quintals, when they are plentiful, may be set apart for the proposed desiccation, that is, for being made into flour. This flour may be mixed with the fecula, the pulp, and some wheaten leaven, and a paste formed of it, which may be treated exactly the same as sea-biscuit, and which may be kept as a resourse when fresh potatoes cannot be had. This biscuit, preserved from rats and moisture, acquires on the fire, with a little fat, salt, and water, the form and taste of a panado, very suitable for mixing with leguminous soups, and for rendering them of a desirable consistence.

M. Parmentier afterwards adds some reflections on the conversion of potatoes into bread. The result of these reflections is, that the only economical process for this purpose, which is mixing the potatoe flour with two-thirds of wheaten, is not practicable except in a small way, by private individuals, who bake their own bread; and that, even if the process could be simplified, it must be renounced in the large way, because in a bake-house all the manipulations go on together, and succeed rapidly.

Now, if the baker, in order to live by his trade, finds it necessary to bake as much as six batches, which employ half the day, he can only bake four of the potatoes.

Method of preserving Potatoes for a great number of Years, by reducing them to Flour, even when they have been frozen. By M. De Lasteyrie.

From the Bulletin de la Societe' D'Encouragement.

The process consists in disuniting and dividing, by maceration, the constituent parts of the potatoe, and in taking from it, by means of water, the extractive matter which, by combining with the air, would give to the flour a rough taste, and a disagreeable colour.

By this method of treating potatoes a great advantage is obtained over that which is employed for obtaining the fecula. The labour is not more considerable, and the produce is much greater; for three ounces only of fecula, at the most, can be extracted from a pound of potatoes, with great care; whereas, by this process, two pounds and nearly three-quarters of flour are obtained from ten pounds of potatoes; for fifty-three pounds, that M. de Lasteyrie put in maceration, produced fourteen pounds six ounces of flour. Thus all the nutritive parts are preserved, the water of combination alone disappearing.

To make *bouillie* with milk or water, a very little of this flour should be used; it is as good as wheat flour for making white sauces, and for all other culinary purposes where wheat flour is employed.

M. de Lasteyrie's process has an advantage that merits the attention of the public, which is the preservation of a prodigious quantity of potatoes which every severe winter takes from the general consumption.

M. de Lasteyrie has made his experiments only in the small way, but it seems that the produce would be the same in proportion to the quantity.

On

On the Fecula of Potatoes. By M. MARGOUX.

From ANNALES DE L'AGRICULTURE FRANCAISE.

M. MARGOUX declares that the fecula well prepared is incorruptible; that it imbibes the moisture of the atmosphere, and parts with it again spontaneously in dry weather, without any care or alteration.

The author kept a quantity, of twelve thousand pounds, in a corner of his bed chamber, for four years. In order to keep it clean, he covered the floor and walls with paper, and as the heap encreased he confined it with boards, and covered the top, in order to defend it from dust. After four years he bolted or sifted, and sold this fecula without perceiving any alteration or receiving any complaints of it.

He had five or six thousand sifted in sacks, of twenty-five pounds each, on the floor of his loft. The sacks were not closed: he examined them during some very damp weather, and found that the fecula in the hand was like mud. He thought it spoiled, but in dry weather it returned to its original state, without having suffered. His sieve was of silk, and remained all the summer without being moved. Some of the fecula always remained attached to it, but he never perceived any punctures in it, which is a proof that it had not bred any worms, and that it had no other enemies than the rats and mice, which were very fond of it.

It may, therefore, be packed in boxes, casks, or sacks, and placed wherever we please, provided that the place be airy and not too damp.

On

An excellent Method of draining Wet Land to render it fit for Culture.

From the ANNALES DES ARTS ET MANUFACTURES.

LOW lands, as well as meadows, may be drained, if not all at once, at least by degrees.

In the first place, pits must be dug in the lowest places, of four or five feet wide, and seven or eight feet deep. The earth thrown upon the sides to be afterwards spread over the surface, and to raise it a little. As many holes may be dug as we choose, because the more there are of them, the more rapidly the land drains.

From one pit to the other are dug small ditches, from two to three feet wide, and four or five feet deep. The pits and ditches are heaped to a certain height, which is determined by the state of the soil, with rough pieces of stone, so that the water may filter through the interstices.

Above this bed of irregular stones is placed a base of flat stones, which is covered with the earth taken from the excavations. The soil can then be cultivated as before.

Method of preparing the Branches of Hops for spinning.

From the Annales des Arts et Manufactures.

After the hops are gathered, the branches are cut into strips, of the length of three ells; they are exposed to macerate in the dew for a few nights, then in running water, and are afterwards dried in the air. They are beaten and crushed, and then treated in the same manner as flax.

The cloths made from this material are stronger than those made from flax or hemp.

Method of preserving Asparagus for the Winter.

From Archives des Descouvertes, &c.

Cut off the lower part of the asparagus, and boil them in water, in an earthen vessel or tinned saucepan. As soon as the water boils, the asparagus is to be put into it, being previously well washed: the vessel is afterwards to be taken from the fire, covered with a napkin, folded into several doubles, and left at rest for an hour.

Then put the asparagus to drain in a sieve, envelope them in another linen cloth, and put them in a place where the sun cannot penetrate, in order to cool, and finish drying them.

In the mean time boil some salt in water, and when this solution is cold, put the asparagus into glass or earthen bottles, and moisten it with the salt water. To prevent the contact of the air, cover the surface of the bottles with fat. When the asparagus is wanted for use in the winter, put it into water, and eat it like fresh asparagus.

On

On Tannin, and on some new Combinations of the Gallic Acid with Vegetable Substances. By M. Pelletier.

From the Annales de Chimie.

Tannin is one of the substances which have most exercised the sagacity of chemists. A collection of the different memoirs that have been published on this subject would fill several volumes. Yet, notwithstanding the numerous works of Séguier, Deyeux, Proust, Davy, and several other chemists, we have no clear ideas upon this matter; the most able professors find themselves embarrassed when they have occasion to speak of this immediate principle of vegetables. We are astonished when, in the works of the learned gentlemen I have mentioned, we find properties so different attributed to the same body. And, indeed, the tannins obtained by the processes which have been successively proposed have been different in most of their properties. They have in common only, the faculty of uniting with several animal substances, of forming with them combinations almost insoluble, and which are not susceptible of putrefaction; they have, besides, all of them the faculty of precipitating, in a manner nearly similar, the same metallic solutions; but they are different in taste, colour, solubility in water, &c. &c. We may say, therefore, that pure tannin is not known, or rather that it does not exist. The properties that have been attributed to it, and by which it has been attempted to distinguish it, belong to several of the combinations which vegetables form of themselves. I doubt not, but that if the learned chemists, who have been engaged upon tannin, had considered it as possible to be a combination

bination, they would have discovered the true nature of the tannin matter.

Why do they continue to consider this matter as an immediate principle? is it because it precipitates several metallic oxyds from their solutions? but most of the extracts have this property, and it is known that the extracts are at the least triple combinations of acid, of colouring substance, and of vegeto-animal matter. Is it because the precipitates that form the tannin matter in these solutions are gifted with constant, and often lively and brilliant colours: but if it is considered that the gallic acid always accompanies the tannin, and that the colour of the precipitates furnished by the tannin matters in the metallic solutions are the same as those that are manifested by the addition of the gallic acid in the same metallic solutions, might we not then conclude with M. Thenard, ("Memoire de la Société d'Arcueil,") that the colour of its precipitates is owing to the gallic acid, which, according to this philosophy, can never be entirely separated from the tannin, and which I regard as one of its constituent parts? will this be the property that tannin possesses of combining with animal matters, and of preserving them from putrefaction? But numberless combinations of vegetable matter possess this property, and not to speak of the astringent matters formed by the action of the mineral acids upon the charcoal in several vegetable matters, without referring to the fine experiments of M. Chevreul* upon hematine, which in several of these combinations acquires this property, I shall venture to give some observations that I made while employed on

* This chemist has told me that he no longer believes in the existence of tannin. The Analysis of Gall-Nuts, which he is on the point of publishing, will, without doubt, remove the uncertainty which still exists respecting this matter.

 the

the analysis of the juice of hypocistes, and which tend to prove that the gallic acid can combine with several vegetable matters, and thus acquire the properties of tannin.

If some gallic acid be poured into a solution of pure gelatine, no precipitate is formed, neither does this acid produce any cloud in gummy solutions; but the union of these substances cannot take place until the liquor be troubled by the formation of numberless white flakes, which at length precipitate.

Among these pharmaceutical extracts there are a great number which contain no astringent principles, and which form no precipitate in the solution of gelatine; but by the addition of a certain quantity of gallic acid they acquire this property. The same phenomenon does not occur with the other vegetable acids, which seem, on the contrary, to oppose the precipitation of the gelatine.

We know that pure gallic acid forms no precipitate in the solution of sulphate of iron at the *maximum*, but fixes a fine deep blue in it. The infusion of gall nuts, on the contrary, produces a precipitate in it which is attributed to the tannin; but the gallic acid itself acquires the property of precipitating in part the iron of this solution when associated with extractive matters.

Most of the vegetable infusions act with the gallic acid and gelatine like the extractive substances, and the reason is plain; the phenomenon is very evident with the infusion of saffron made cold.

The properties of these precipitates ought not to be absolutely identical; they ought to differ according to the nature of the substances that enter into each combination: that formed by gum arabic, gelatine, and gallic acid, is the only one that I have hitherto been enabled to examine; it varies from the others by its extreme ad-

herence

herence with water, so that it is under an oleaginous form, and a portion will pass through filtering paper.

This combination appeared to be capable of existing in different proportions; but I have not yet been able to satisfy myself, whether these proportions are determined. This much is certain, that in several circumstances it does not putrify; in others the fetid odour is manifested, although at the end of several days, and much later than if the gelatine is pure. The combinations of gallic acid with gelatine and the extractive matters are less greedy of water, and approach much nearer to the precipitates formed by an infusion of gall nuts in the gelatinous solution. I intend, when I shall have prepared enough gallic acid, to continue these experiments, which I think are of a nature to throw light upon some of the phenomena of vegetable chemistry.

Method practised in Germany of bleaching Virgin Wax.

From the Annales des Arts et Manufactures.

In Germany they bleach virgin wax rather by simple exposure to the air than by chemical means. This method indeed is longer, but it is also the most economical.

In following this process, they begin by melting the yellow wax in water, and when melted it is left to deposit, for a longer or shorter time. The water and the dregs precipitate slowly to the bottom of the vessel, afterwards the wax is wound round a cylinder, which is turned in the water. By this means it is divided into very thin flakes, of from three to four inches long. They also use for dividing the wax large shears, which are put in motion by the simple mechanism of a water-wheel.

When the wax is thus divided it is put upon vast frames, furnished with linen cloth, and left exposed to the immediate action of the air and light. These two agents combined, gradually take out the colouring substance, and with the greater facility, from its being reduced into thin flakes. In this manner, at about the end of three months, the wax is rendered completely white.

When the heat of the sun is too strong, the wax will become tough, and will unite, unless care be taken to turn it two or three times a day, and to moisten it when the water is judged to be entirely evaporated. But it is always observed, that when the sun has been ardent enough to melt the wax, it is no longer capable of acquiring the degree of whiteness of which it was previously susceptible. But as a great quantity of water, which will be spread over its surface, must necessarily injure it, sheds are disposed at the sides of the places where it is spread. Lastly, in order to enclose the wax with facility, grooves are made in the frames which are in the open air, and by which the platforms containing the wax are expeditiously drawn out.

When the wax has lost its yellow colour it is collected in order to be re-melted; the finest and driest part keeps at the top, the thick part precipitates in the tub, and settles between the water and the good wax. This separation occasions a waste in the wax of about one *per cent*.

This operation terminated, the wax is again formed into thin flakes, and exposed, as before, to the power of the sun, where it is left until it is judged to be completely bleached; it is then formed into lumps, which are once more exposed to the sun, in order to give the wax its highest lustre. When once the wax has acquired the utmost degree of whiteness of which it is susceptible, if it is left any longer exposed to the light or the air, its

its brilliancy, far from being augmented, will, on the contrary, be considerably diminished.

In following the second method, they begin by melting the yellow wax, and, when it is melted, they pour into it a solution of lime in oxygenated muriatic acid. Care must be taken that the solution be neuter; that is, that it have not an excess of acid; for if the muriatic acid predominate it will render the wax lumpy. After the solution is poured in, the mixture must be strongly agitated until the wax becomes completely white. By this process the acid seizes on the colouring substance, and speedily destroys it, but less perfectly than by the simultaneous action of the light and the air.

This last process has the advantage over the first, of being more expeditious, of not requiring spacious premises, and of being practicable at all seasons; but it has also the disadvantage of being less economical, and of never producing such a brilliant white.

Memoir on the Employment of Oxygen Gas in various Cases of Suffocation. By M. Sementini.

With an Engraving.

From the Annales de Chimie.

THE object of the work which I now offer, is to propose a quick and efficacious remedy for recovering drowned persons, and for various cases of suffocation in general. Suffocation is the state in which life is suspended, so as to destroy all power of sense or motion; but which we may reasonably expect to see restored.

This state may be expressed by comparison with the motion of a pendulum, which ceases only from its oscillations being mechanically suspended, while none of the pieces

pieces which compose the machine are at all injured. Now, when there is only a want of sense and motion, caused by an absolute suspension of the same faculty, we may hope for the return of life, by giving to it such an action that it may resume its natural state, as the pendulum resumes its functions, when a mechanical impulse has restored its oscillation.

But the animal condition is such, that the suspension of life speedily becomes dangerous, and apparent death soon changes to reality, on account of the facility with which the humours in a little time are altered.

Now, suffocation may be produced by causes which act either upon the general system, or directly upon the organ of respiration; but I here mean to speak only of those cases which, deriving their origin from any given cause, have immediately occasioned such a derangement of the functions of the lungs as to produce apparent death.

Having lately directed my attention to the contrivance called fumigatory boxes, it occurred to me, that inflation being generally regarded as the most powerful method of restoring life, oxygen gas might be employed instead of atmospheric air. I afterwards became acquainted with Dr. Goodwin's work, published in London in 1788, and I found that this author had tried oxygen gas, administered by inflation, to animals drowned on purpose, and that he had ascertained its efficacy. I repeated his experiments, in which I succeeded, and which confirmed the confidence that I felt in this method.

But the case of an animal drowned on purpose, and saved by the inflation of oxygen gas that had been previously prepared, is very different from that of a man in the same state, whom we wish to restore by this means. In the first case, every thing is arranged for the experiment,

ment, and the oxygen gas is prepared before hand; but when it is required to afford speedy assistance to a person just taken out of the water, too much expedition cannot be used in extracting the gas, and in administering it. To accomplish this, which has not yet been attained, a simple method is necessary, by which the oxygen gas can be immediately obtained, and by which it can be instantaneously introduced into the lungs while yet warm. The object of this memoir is to make public the method which I have invented.

In order to succeed in this undertaking, I availed myself of the lights of modern chemistry, and of Berthollet's important discovery, that is to say, the *super-oxygenated muriate* of potash, which, among its wonderful properties, has that of containing nearly one-third of its weight of oxygen, which, on being exposed to a moderate heat, is reduced to the state of gas, and it is on this remarkable property that my method is founded.

If inflation, therefore, be the principal resource in certain cases of suffocation, if for this purpose the employment of oxygen gas be preferable to the atmospheric air, and if the machine that I propose be capable of developing the oxygen gas in a very short time, and of introducing it immediately into the lungs, I shall not have employed my humble talents without use in the cause of suffering humanity.

Explanation of the Plate.

At Fig. 1 (Plate XIII.) A is part of a column of wood, ballasted with lead, upon which is screwed the brass retort B. To the foot of the column is attached a spirit-lamp C, the flame of which surrounds the belly of the retort. To the same column is applied a flexible leather pipe

pipe *d d*, which, at the other extremity, unites at F with the bellows E. These bellows terminate at G, with a portion of a tube of elastic gum, which is furnished with a brass plate, that may be adapted to the human mouth. The bellows are provided, at F, with a valve. The operation of inflating the gas is effected as follows. The column A is placed upon a small table, where the suffocated person lies in a horizontal position; the *super-oxygenated muriate of potash* is introduced into the retort B, which is then screwed to the column. The lamp is lighted, and the bellows E are applied to the mouth, while an assistant holds the nostrils with his fingers. The oxygen gas begins to be developed; and, as in the interior of the cylinder the aperture of the retort communicates with that of the tube *d d*, this gas, having no other vent, is carried into the bellows, which are kept open on purpose.

When it is supposed that the bellows are full, or nearly so, they are closed; and it being impossible for the gas to return, the valve being shut, it is compelled to enter the mouth and lungs of the patient. This process, which is several times repeated, without neglecting other known remedies, forms the essential part of the very simple method which I propose.

I have had the satisfaction of saving with this apparatus a man drowned on the sea coast, who in a very little time was restored to life.

Report

Report made to the Class of Natural Philosophy and Mathematics of the National Institute, on the Use of Zinc for the Fabrication of Measures for Liquids, and for Vessels and Utensils for the Use of the Military Hospitals. By *Messrs.* Portal, Berthollet, Deyeux, Vauquelin, and Guyton Morveaux.

(Concluded from Page 254.)

6th. A VERY weak solution of salt of sorrel, formed, even cold, on the sides of the saucepan, a saline stripe. After digestion, on a slow fire, the filtered liquor was sensibly troubled by the prussic liquor.

7th. Soluble tartar, or tartrate of potash, which is much less active than cream of tartar, has in a similar manner given marks of a commencement of decomposition by the affinity of its acid with this metal.

8th. Lastly. The simple digestion cold, during twenty-four hours, of water charged with a twentieth part of its weight of *common salt*, formed a sensible quantity of muriate of zinc, which remained in solution after filtration, and manifested itself on the addition of the prussic liquor.

To these very decisive results I think it my duty to add another proof of the action of water upon zinc, even when it only touches without remaining upon it, by exhibiting to the class a plate of zinc which has been exposed thirty-eight months upon an inclined roof, and which has lost in weight, from that time, as much as eight grammes on a surface of a metre square (about one ounce in the square toise.) If the slowness of the action in this case does not balance the advantages that would result from the durability and solidity of this metal from the possibility of employing it of a much less thickness than lead, of thus diminishing the strength of the timbers,

bers, and of obtaining a lighter and more durable covering than slate, it is certainly less safe to employ it for spouts for pipes which are destined to convey water into cisterns, and especially into baths, where the heat would favour its action. The inspection of the saucepan, in which distilled water had been kept at a temperature not exceeding that of a bath, will give an idea of the daily alteration they would undergo. It is three years since, that I put into a bottle some of M. Dony's small plates of zinc with some rain water. It has neither been unstopped nor agitated during that time; and the Class will see with astonishment the quantity of zinc that has passed to the state of hydrate.

It now remains for us to deduce from these facts the conclusions which the Class is invited to present to the Minister of the Interior and the Minister of War.

Conclusions relative to the Questions contained in the Letter of the Minister of the Interior.

1. *Does zinc contain in its natural state any principles which may be hurtful to the animal economy?*

Zinc before purified is brittle, and not malleable; contains but an infinitely small quantity of arsenic, even when it exists in the ore, and which passes off by distillation.

2. *Do the operations by which it is rendered malleable require any intermedium or mixture of dangerous substances?*

The principal object of the operation for obtaining zinc malleable being to separate by distillation the foreign matters fixed in it, and at the same time to bring it to a perfect metallic state, requires only the presence of charcoal dust, which frees it from the oxygen, and does not remain united with it.

3, *Can zinc, when rendered malleable, and in the state to which*

which it is usually brought, be employed without danger in the composition of the standard measures; and what is the effect of water, of spirituous, acid, or oleaginous liquors, upon this metal?

If the measures be used for dry materials they may be employed without any inconvenience; but the price would be much higher than that of the vessels now appropriated to this use, and we do not at present see any motive for changing them.

As for liquids, it is now generally known that zinc is attacked even by the purest water, by the weakest vegetable acids, such as vinegar, the acids of lemon, sorrel, tartar, milk, fruit, even by the salts formed from these acids, by the boiling of animal flesh, by the empyreumatic vegetable acids, and by oleaginous substances, when they are disposed to be rancid, or are changed by heat.

These facts have been confirmed by the experiments of the Commissioners on the saucepans that were sent to them from M. Perrot, of Liege.

It would be in vain to oppose to these facts, for the sake of authorising its use in the preparation of eatables, that the oxyd of zinc has nothing dangerous in it, that it has been introduced in pharmacy, that some physicians have actually administered as much as 42 decigrammes (about 80 grains) under the name of *flowers of zinc.* It must be observed, that this is the oxyd of zinc prepared pharmaceutically, and not the oxyd obtained from zinc purified by distillation only; an operation which carries off a little arsenic, if the ore contain any, which it often does.

2. If the use, which for some time has been made in medicine, of the flowers of zinc, shews that a moderate dose may be taken internally without producing any vio-

 lent

lent disorder in the animal economy, it supposes at the same time a medicinal action, which could not be habitually resorted to without inconvenience.

3. Indeed, when it is admitted that the oxyd of zinc alone, or simply mixed with eatables, does not render them insalubrious, we must be careful of concluding, that the vessels made of this metal can be employed without danger, either for the preparation of food or for measuring liquids, since it is not the simple oxyd, or even the oxyd united with water in the state of hydrate, that would alter its properties, but rather the compounds resulting from their union with the acids which exist in abundance in all the ingredients habitually employed in their preparation, and of which the Commissioners have noticed those that are most common. It is known, that in general the *metallic salts* are, acid, tart, emetic, corrosive, some of them venemous, and that those which are described in the pharmacopeia's, as internal medicines, cannot be administered without much precaution, and in quantities proportioned to the violence of their action.

4. *When zinc has been rendered malleable, can it be adulterated by the mixture of hurtful substances; and by what means can the mixture be discovered?*

All the known mixtures with zinc, if we except that of copper, causes it to lose its ductility, however small may be quantity of the metal with which it is alloyed; therefore, there can only be but a little arsenic which can be accidentally present in zinc purified by distillation. It is easily discovered, as M. Proust has remarked, by dissolving the suspected zinc in diluted sulphuric acid, and adding to the solution some hydro-sulphuretted water, which precipitates the arsenic in the state of yellow arsenical sulphuret.

If

If then we could reckon upon a manufacture in which zinc would be constantly brought to the purest state, the manner, so completely proved, in which it is liable to be affected by all liquids, even cold, with which it forms compounds, which cannot be taken internally without some degree of danger, will not permit us to consider it as perfectly safe to be used for making vessels in which liquids are to be measured.

Conclusions relative to the Question contained in the Letter of the Minister of War.

Can zinc be employed with advantage in the place of copper for the vessels and utensils that are used in the military hospitals?

If the vessels and utensils, which are proposed to be made of zinc instead of copper, be destined only to contain water, although the Committee are convinced that pure water will attack this metal, in consequence of the experiments made on the vessels of M. Perrot, they might still be used to a certain point, when the oxyd of this metal may be given as a medicine, as far as the quantity of from 40 to 50 decigrammes, taken at different times in the course of a day, supposing that it did not remain more than the above time; for it must not be dissembled, that the daily conversion of a portion of metal into oxyd would not fail to occasion in the course of time an alteration, so much the more considerable as it would be favoured by the heat, and at length would render the vessels unfit for use.

But when it is proposed to employ these vessels in the preparation of food and drink, it is no longer the properties of the simple oxyd of zinc that are to be considered, but the properties of the *saline compounds*, which it forms with so much facility, both with the weakest acids and

with

with the salts which are always contained in the most common alimentary substances, and in the materials which are employed to season them; compounds which, like all metallic salts, are generally acerb, styptic, sour, emetic, some of them corrosive, and the use of which have never yet been directed in the pharmacopeia's, except as external remedies.

The assertion of M. Perrot, that, for two or three years, several persons have used his kettles and saucepans made of zinc without experiencing any inconvenience from them, cannot balance considerations equally weighty, founded on the principles established by the most celebrated authors, on the reports made to the Institute, to the Faculty, to the Committee of the Arts, supported by the experiments which the Commission was careful to repeat, with the most scrupulous exactness, on M. Perrot's vessels, and of which the results admit of no other conclusion, than that these vessels cannot without danger be employed in the preparation of food and drink.

The Class adopted these resolutions, and decreed, that they should be sent with the Report to the Ministers, who had written for information on this subject.

N. B. The following passage, extracted from the "Treatise of the Medical Police," published last year at Helmstadt, by Dr. Remer, will shew the opinion of the Committee of Health relative to the employment of zinc for vessels destined to prepare food.

"We have made experiments relative to the object of substituting zinc for tin, or for hardening tin by alloying it with this metal; but they have not succeeded; the composition is never uniform; it oxydates very speedily. It ought not, therefore, to be employed to cover copper, especially as the zinc dissolves in acids with more facility than tin. To cover copper with zinc is not better, be-

cause

cause zinc oxydates as well as copper, its oxyd is very soluble in acids, and in that state it is very deleterious."

We think it our Duty to place at the End of this Report the Letter of the Minister of the Interior to the Prefects of the Departments.

M. le Prefet. The Arts are indebted to Chemistry for the discovery of a new metal, which may be rendered of great utility, and merits encouragement. This metal is zinc, which has also been rendered malleable.

In recommending you to encourage the use of this metal, which may in many cases be substituted with advantage for tinned iron, lead, tin, and copper, I think it my duty, however, to acquaint you with the limits to which the use of it ought to be confined. They have been signified in a report which I have received from a Class of the Imperial Institute, relating to various questions, which I proposed to them in consequence of an application, requesting me to authorise the manufacture of this metal into the standard measures for liquids instead of tin. The conclusions from this Report are, that even if we could be certain that zinc would be always rendered perfectly pure, (that is, purified from the small quantity of arsenic that may remain combined with it,) the manner in which it is affected by all liquids, even cold, and the compounds which it forms with them, which cannot be taken internally without some degree of danger, does not admit of its being consideredas free from inconvenience for measuring liquids.

It is a necessary consequenee of this conclusion, that vessels formed of this metal cannot be used without danger in the preparation of food and drink. It is, indeed, one that the First Class of the Institute mentions in the same Report, in answer to a question proposed by the Minister at War, and which was to enquire if zinc could

be

be substituted with advantage for copper in making vessels and utensils for the use of the Military Hospitals.

You will do well, therefore, Sir, to give an order to the examiners of the weights and measures not to admit to the examination any measures made of this metal intended for liquids; and, as for the vessels destined for domestic use, which may be manufactured of it, it is sufficient that I have acquainted you with the probable danger of employing it; and your zeal will guide you in the measures necessary to be taken, in order to preserve the health of the citizens of your department.

List of Patents for Inventions, &c.

(Continued from Page 256.)

Michael Larkin, of Blackwall, in the parish of St. Dunstan, Stepney, in the county of Middlesex, Shipwright; for improvements in windlasses for ships and other vessels. Dated August 16, 1814.

Henry William Vanderkleft, of No. 253, High Holborn, in the county of Middlesex, Gentleman; for constructing a walking-staff, to contain a pistol, powder, ball, and telescope, pen, ink, paper, pencil, knife, and drawing utensils. Dated August 17, 1814.

Robert Salmon, of Woburn, in the county of Bedford, Purveyor; for improvements in the construction of machines for making hay. Dated August 22, 1814.

John Dickenson and George Dickenson, of Nash Mills, in the county of Hertford, Paper-makers; for improvements in the said John Dickenson's patent machinery for manufacturing paper, and also a certain apparatus for separating the knots or lumps from paper or paper stuff. Dated August 24, 1814.

THE

REPERTORY

OF

ARTS, MANUFACTURES,

AND

AGRICULTURE.

No. CL. SECOND SERIES. Nov. 1814.

Specification of the Patent granted to JOHN LEWIS, *late of Llanelly, in the County of Carmarthen, but now of Penclawild, in the County of Glamorgan, Assayer of Metals; for an Improvement in the Art of smelting Copper* *. Dated July 23, 1813.

With a Plate.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said John Lewis do hereby declare that the nature of my said invention, and the manner in which the same is to be performed, are particularly described and ascertained in and by the drawings hereunto annexed, and the following references or description thereof; that is to say: My invention of an improvement in the art of smelting copper ore consists in building my ore and metal furnaces between two calciners, and elevating the same above the said furnaces. Secondly; I cause the ore and metal, when calcined, to be conveyed,

* Patent granted "*for certain improvements in the art of smelting copper.*"

red hot, through iron pipes, direct to the furnace. Lastly; I lengthen the rim of the metal from the furnace to the metal pits.

I further declare, that the drawing annexed represents the ground plan and section of the said calciners and furnaces, with a front view thereof; and that the component parts are referred to as under.

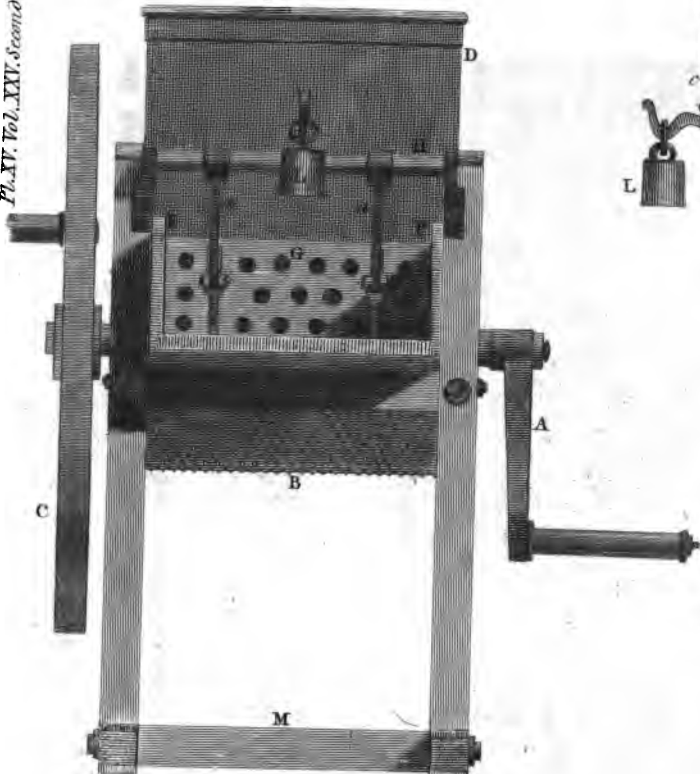
A A, Fig. 1, (Plate XIV.) two calciners, elevated above the furnace. B the furnace. C the furnace stack. D the side door of the furnace. E the front door of the furnace. F the furnace tap hole. G the furnace grate. H the metal pit. I the trough, or rim, from the furnace to the metal pit. K three flues to calciner and furnace stacks. L the furnace charge hole. M, 2 the calciner stacks. N, 8 the calciner doors. O, 4 pillars, one between two calciner doors. P, 2 the calciner grates, which I make smaller than commonly used. Q, 3 the ash-holes. R, 2 the arch-ways under the calciners. S the stage for calciner man. T, 4 the calciner charge holes. U, 4 the iron pipes for conveying the ore or metal when calcined into the furnace. V. 3 passages to side door, tap, and ash hole to calciners and furnace. W, 3 the calciner and furnace feeding holes.

And I also declare, that the following advantages are to be derived from my said invention: First; the same work may be done in less time, and with fewer furnaces. Secondly; there is no waste of ore or metal from removal. Thirdly; there is no explosion from the metal pit to injure the building. Lastly; there is a considerable saving of fuel, labour, and materials.

In witness whereof, &c.

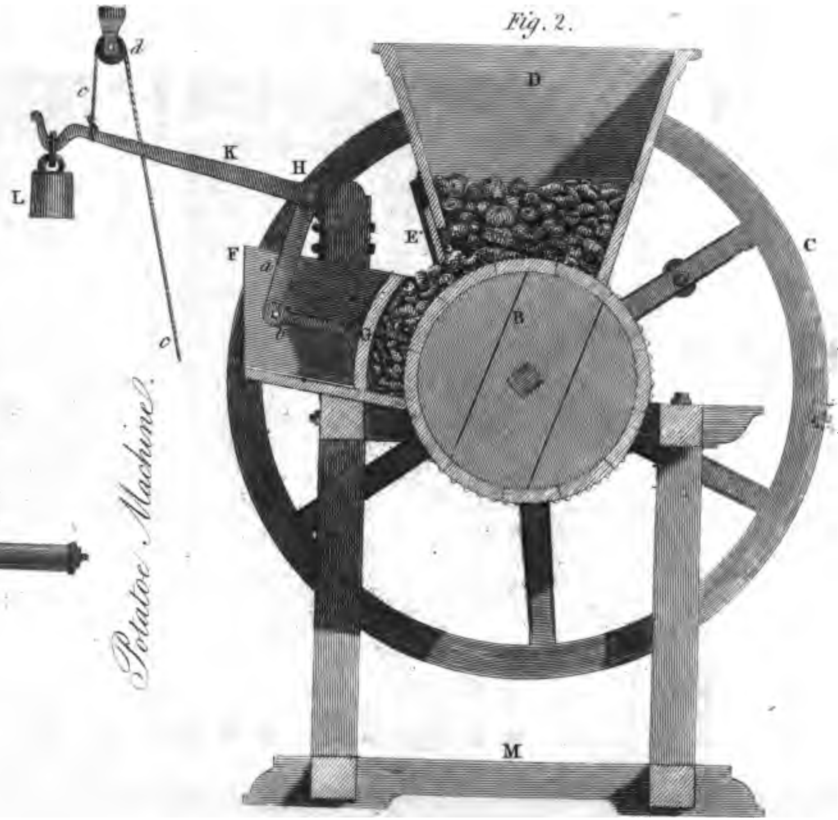
Specification

Fig. 1.



Potatoe Machine.

Fig. 2.



Specification of the Patent granted to George Smart, *of Ordnance Wharf, Westminster Bridge, in the County of Surrey, Timber Merchant; for certain Improvements in Machinery for grinding Corn and various other Articles.* Dated April 1, 1814.

To all to whom these presents shall come, &c. Now know ye, that I the said George Smart, in compliance with the said proviso, do hereby declare that the nature of my invention, and the manner the same is to be performed, are particularly described and ascertained as follows; that is to say: In order to reduce the labour in grinding, and adjust the power, to the required force, and also to simplify and reduce the expense in mill-making and grinding, so as to enable the farmer and housekeeper from being dependant on the present practice of grinding; every article required to be broke or ground, may be performed by the application of rubbers or crushers, resting on their fulcrums, and are pressed against the revolving body by means of levers, weights, or springs; the rubbers or crushers, acting each on a separate axle, will admit of any irregular surface, from a square to a circle, to revolve against them, as each can be loaded, more or less, by moving the weights on the levers farther or nearer to the fulcrum; or, if with springs, by screwing them more or less down, as may be required. The rubbers or crushers may be plain, grooved, circular sided, concave, or any other figure best adapted for the substance to be broke or ground. The square, or octagon, are best adapted for breaking cement-stones, bones for manure, chalk, mixing clay, mortar, &c. For breaking malt, beans, &c. one crusher is only wanted;

 but

but for wheat, oats, barley, rice, or any flour or meal, the more rubbers or crushers the finer the article will be ground: and the more flats there are on the revolving body the more crushers can be applied to advantage.

In witness whereof, &c.

Specification of the Patent granted to ROGER HASLEWOOD, *of Great Russell-street, Bloomsbury-square, in the County of Middlesex, Ironmonger; for folding Screens, adapted to impede the Passage of Air, Smoke, Fire, and Light, applied to Fire-places, Grates, Stoves, Windows, and Doors, which I denominate "The improved folding Screen."* Dated April 21, 1814.

TO all to whom these presents shall come, &c. NOW KNOW YE, that in compliance with the said proviso, I the said Roger Haslewood do hereby declare that the nature of my said invention, and the manner in which the same is to be performed, are particularly described and ascertained as follows: that is to say: The patent folding screen is formed by any number of plates, or flat surfaces, of metal, or any other material, more than one in number, suspended from the various diameters of the circumference of a pulley or roller, having various diameters, and counterpoised by a power equal to the weight of the said plates; the result of which arrangement of parts is, that when any one of the said plates is moved by a force applied upwards or downwards the whole number will ascend or descend in such proportions of motion as the various diameters produce.

In witness whereof, &c.

Specification

Specification of the Patent granted to WILLIAM CLERK, *Esquire, Advocate; for preventing Smoke, Dust, and the Danger of Fire, and for increasing and regulating Heat from Stoves and Chimney Fire-places, for heating Rooms, Halls, Passages, and Stair-cases, in public Buildings and dwelling Houses, and all other Apartments where regulated Heat and Cleanliness are desirable, without obstructing the View of the burning Fuel.*

Dated May 2, 1819.

TO all to whom these presents shall come, &c. NOW KNOW YE, that the said William Clerk doth, by this instrument in writing, under his hand and seal, duly executed, describe and ascertain the nature of his invention, and the methods by which the same may be performed; that is to say: The said invention is susceptible of various forms and modifications, according to the particular nature and situation of the apartments, or the particular situation and form of the place in which the stove or grate is to be placed; as, for instance, first, when the grate or stove is to be placed near the wall of an apartment, or within an ordinary fire-place, the grate for containing the fuel is to be inclosed, excepting on the side towards the apartments, with upright plates of iron, or other suitable material, and covered on the top with another plate of the same material, having a pipe or aperture on or near the top, of proper diameter, for conveying the smoke of the fire into the chimney, and, excepting by this pipe or aperture, there ought to be no ordinary access of air into the chimney. On the front, which thus remains open towards the apartment, and accurately fitted on the sides and top above described, is to be placed a frame of metal, or other proper material, having various

various bars and subdivisions, with proper grooves in each, into which are nicely fitted pieces of glass, of proper form and size. In its simplest form, this frame or screen is constructed of upright bars, crossed or checquered with other bars, in a horizontal or other form, into the openings of which the glass is fitted, or having the pieces of glass so accurately cut, and brought so exactly into contact with one another, at the upper and under edges, as to supersede the necessity of any cross or horizontal bars. For the purposes of ornament, and without impeding its utility, the frame or screen may be constructed in imitation of a Gothic shrine, or in various fanciful and elegant forms, having the pieces of glass either plain or cut, stained or painted. The frame of glass ought not to be placed nearer the grate than nine or ten inches, and the pieces of glass ought not in that case, nor in general, to exceed three inches square, otherwise the glass is apt to crack or break. But in these respects considerable varieties are admissible, provided the size of the pieces of glass bears a due proportion to the distance of the frame from the bars of the grate, and to the greater or less intensity of the heat to which the glass is exposed. The frame is so constructed as either to be occasionally removed altogether, or to open totally or in part, by means either of hinges or sliding grooves, or otherwise, so as to give access, when necessary, to the fire-place. In order to supply the fire within the stove with air, two different expedients are employed, either separately or alternately. In the first place, by means of a tube, with a valve or stop-cock, communicating between the interior of the stove and the external air, or the air of some contiguous apartment: the fire is supplied independently altogether of the air of that apartment which it is intended to warm. Or, in the second place,

place, in the lower part of the screen nearest to the hearth, or in the sides of the stove, an aperture is made, having a proper regulator or damper, which may be opened or shut at pleasure. In this last manner the fire may be entirely supplied with air from the apartment where it is placed; or if the valve of the tube, in the first method, be partially or totally opened, the supply may be furnished partly from the apartment and partly from the external air; or the alternate accumulation of heated air, and renewal of cool and fresher air, in the apartment, may be managed and regulated at pleasure.

The effects and advantages of this invention, when thus applied, are various. In the first place, it has the effect of heating the apartments more easily and equably than by open fire-places, by admitting of an accumulation of air heated by immediate contact with every part of the stove, as well as by radiation from the body of the stove, and through the diaphanous screen, which is placed in front of it, while at the same time this accumulation may be occasionally checked or diminished, and a gentle or regulated ventilation may be had by means of the aperture with its damper in the lower part of the stove, or even by opening the screen, by means of its hinges or sliding grooves. Next, a fire-place thus constructed effectually prevents all the inconveniences so much felt and complained of, occasioned by smoke and dust, as well as the hazards of fire, arising from sparks or from the falling of pieces of the burning fuel; while at the same time, and in the third place, the view of the fire is not obstructed, and the chearfulness and comfort of an open fire-place are retained. It is the combination of this last circumstance with the former which gives to this invention its peculiar character, and its superiority over any species of stove or fire-place now in use.

Secondly;

Secondly; when the stove or fire-place is to be situated in the centre of an apartment, or at a distance from the walls, the grate may be circular, or of any other convenient or elegant form, and is to be surrounded and inclosed with a frame-work, of materials and construction, similar to those of the screen above described. Over this surrounding screen, and in contact with it, is placed a top or canopy, of metal, or other proper material, from which proceeds the flue or tube that conveys the smoke. The fire is to be supplied with air by the means already specified under the former head; and by similar management the heat and ventilation of the apartment may be exactly regulated.

Thirdly; in combination with ordinary grates, or in open fire-places, or with register stoves, this invention is usefully and conveniently applied by placing a diaphanous screen, of the construction already described, accurately fitted to the openings in front of such stoves or fire-places, and by supplying the fire with air, either from without or from within the apartment, by means of the apparatus already specified under the former heads. When employed in this less perfect manner the process of heating the apartment requires a greater consumption of fuel, but in other respects the advantages are similar in kind, if not in the same degree.

In witness whereof, &c.

Description of a Machine for the speedy Separation and Manufacture of Farina or Flour from Potatoes, and for various Observations relative to the Necessity of encouraging an extended Growth of Potatoes, and for their Applications, in various States, to make Sea Biscuits, Bread, Pastry, &c.

By JOHN WHATELY, *Esq. of Cork.*

With a Plate.

From the TRANSACTIONS of the SOCIETY for the Encouragement of ARTS, MANUFACTURES, and COMMERCE.

The Lesser Gold Medal was voted to Mr. WHATELY *for this Invention.*

IT is naturally the first object, and forms the primary duty of a well-regulated State, to provide its members with a sufficient quantity of good food. The greater are the advantages, and the more independant, is the situation of that country, which can furnish within itself a full and ample supply of the means of subsistence to its inhabitants. We have long ceased in this country to feel the benefits arising from such a state of independence, and we have during the last ten or fifteen years incurred a very large expenditure in the purchase of foreign corn. This subject has engaged much of my attention, and I have endeavoured to devise a plan by which the agriculture of this country may be improved, a great expenditure saved, and a considerable reduction of prices effected, by the introduction into bread of an article of known nutritious properties derived from the potatoe. This substance is the farina or flour of that valuahle root, which I have tried with advantage to a very great extent, having previously gone through a long course of experi-

 ments

ments on making bread, biscuit, and pastry, from mixtures of raw potatoes, and boiled potatoes and farina, with different proportions of flour, &c.

It is well known that poor light soils, unfit for the culture of wheat, and from which only crops of barley or oats have been produced, and of which, in many situations, there are large tracts of land altogether uncultivated, will produce potatoes of excellent quality; two circumstances have, however, hitherto prevented their culture to the desirable extent, namely, the great expense of their carriage in a raw state from the interior parts of the country to a proper market, and their not keeping well more than six months after the crop is gathered.

These inconveniences I have obviated by the invention of a machine which is now at the Society's house, by which one individual can grind down fifteen hundred weight, or seventeen hundred pounds nett of potatoes, into soft pulp, in one day, yielding about two hundred weight of farina or flour when dried.

By calculation, the power of a single horse will be equal to the grinding of twenty-two tons of potatoes *per* week; the machine is capable of being applied to any power required. The farina or flour has been known to keep good seventeen years, and it may be afforded so as to yield a fair profit to the farmer and the manufacturer, at three pence *per* pound. The present price of wheaten flour is about five pence farthing.

It would be tedious now to enter into a long detail of this business by letter, but my son is in London, and if he is permitted to attend a Committee of the Society, and to give proofs of the trials I have made, by exhibiting specimens of the bread, flour, and biscuits, and by furnishing such other particulars as may be required, I trust they

they will perceive the great benefits that may result from this article, and particularly if my communications should merit the sanction of the Society, and be honoured with their approbation.

Remarks from Mr. Whately, *on Potatoes.*

It may not be generally known, but it is capable of the most satisfactory proof, that the same quantity of land will yield above one half more of farina or flour where potatoes are cultivated, than if the same land was applied to the production of flour from wheat.

I have proved from experiment, that 2619 pounds of pure farina or flour may be produced from an acre of land planted with potatoes, and only 1660 pounds of flour from an acre of wheat. It will therefore be obvious, that, if we can apply this great excess to the same purposes as the flour of wheat, the advantages arising from it will be of the highest importance to the community. We now require from foreign countries about 500,000 quarters of wheat annually, for which we incur an expenditure of about two millions sterling, in ordinary years, and which has increased in years of scarcity to upwards of seven millions sterling, and there seems no probability that, under the continuance of the present system of cultivation, we shall ever arrive at the period, when we can supply our own wants, and feel independant of foreign aid, for one of the first articles of subsistence.

We have had for the last ten years not only a course of favourable seasons, but the farmer has had, in the greater part of that period, the benefit of high prices to stimulate his exertions to the greatest possible production of corn, and if they have failed, under such favour-

able circumstances to satisfy our wants, what evil may we not expect if the seasons should prove unpropitious, and the inconveniences of our situation aggravated by scarcity? I admit, that the prospect of supplies from foreign countries may be great; but we should recollect, that only a few months have elapsed since the ports of Europe and America were shut against us, or only open on a system of licence, and that, in a situation of dependance, which no well-wisher to his country can be desirous to see recur, nor the possibility of which he will not feel anxious to prevent: this, then, is one of the advantages which will attend the consumption of potatoe flour in bread, the earth yields it so much more abundantly, that the very first year's cultivation of potatoes for that purpose, to the extent of only 25,000 acres, would relieve us from the necessity of any foreign importation, and instead of importing, we should speedily become an exporting country. Potatoes are found to possess such highly nutritive properties, that it seems hardly necessary to enter upon that subject: they constitute, it is well known, in their natural state, the principal food of the Irish, and they are daily forming a great part of our own. This farina or flour, which contains the substantial nourishing properties of the root, deprived of its watery particles, cannot but be highly nutritious; the use of it, therefore, in bread, is not likely to be the subject of dispute, provided it is in that state palatable, and can be afforded at a price not exceeding the price of wheaten flour: that it possesses the first-mentioned property, I have only to refer to the bread produced to the Society, containing different proportions of this flour, any, and all of which, will, I believe, be found as wholesome and agreeable as bread made wholly of wheaten flour; in some respects it seems an improvement, as it keeps

keeps much longer, and it rises and becomes very light and agreeable when toasted. Upon the second question, I shall be able to shew, satisfactorily, that the flour of potatoes can be produced at a cheaper price than the flour of wheat, all objection, therefore, to its use in bread, is not only removed, but I conceive the most important advantages will flow from its adoption. In the specimens before you, one-fifth of the farina is the smallest proportion made use of, and two-thirds of farina and boiled potatoes together, when in bread, the largest; calculating, however, that no greater proportion than one-fifth should be generally introduced, the saving of wheaten flour alone, from that circumstance, would be immense. The population of Great Britain consists, according to the latest returns, of upwards of twelve millions and a half, and of this number, it may be conjectured, that about ten millions consume wheaten bread; each individual's consumption has been considered equal to a quarter of wheat *per annum*: the introduction of potatoe flour, therefore, generally, would produce a saving of two millions of quarters of wheat *per annum*, and instead of being, as we now are, an importing nation, we should, after supplying our present deficiency, have a surplus of about 1,500,000 quarters for exportation, which, at the present permitted export price, under 54*s*. *per* quarter, would be equal in value to four millions sterling! That this surplus would not be obtained without some sacrifice of other crops, I am ready to admit; but when the increased productiveness of the potatoe is considered; when it is calculated, that large tracts of land may be cultivated upon this system that would not be cultivated upon any other, and that the plan may be generally adopted, which prevails universally in Ireland, and has the recommendation of distinguished agriculturists in this country, of making the

the potatoe crop precede the crop of wheat, the sacrifices would upon the whole be few, and the advantages immense. I know that objections exist from the scarcity of manure, &c. but I am satisfied that many of them would yield in practice: the poor Irish contrive to manure the land, and to produce crops that serve to form the winter supply of the city of Dublin, in situations distant from cities, and where artificial manure is not to be had; lime, sand, or sea-weed, are all excellent, and are in many places easily procured; the burning of the surface in rough uncultivated land is almost sure to produce a large crop, and is generally one of the first, as it is found one of the best preparatives to cultivation: the manure from hogs has been stated to afford very great returns; and as it is almost essential to the economical pursuit of the business of manufacturing the potatoes into flour that many hogs should be kept, for the purpose of consuming the skins, refuse, &c. it is a manure that would be abundant in those places where the manufacture was introduced. Perhaps no situations would so strongly feel the benefit of this system as those which are remote from sea-ports, and distant from water-carriage: the ground is now necessarily employed in pasture, or it remains waste. The expense of carriage is an insurmountable bar to the pursuit of agriculture. But let us now consider the situation of a farmer adopting this system: he chooses a remote part of the country, where, perhaps, cultivation did not before exist: he takes the land at probably one-fifth part of the rent which he would pay in more frequented spots, and he either invites the manufacturer of the farina to settle along with him, or he resolves to become a manufacturer himself: the first year he begins by burning and paring the surface of a part of his land, and by this preparation insures

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an abundant crop: he sows the next year barley or oats on the land thus cleaned and prepared, which will serve as food for his cattle, and for the large stock of hogs, that, as a manufacturer of farina, he must support; and he proceeds to bring a farther part of his land under cultivation by the same means. The potatoes are manufactured on the farm; and if he could afford to send the potatoes seven miles to market, in their original state, he can, without disadvantage to himself, convey them fifty in their manufactured state, as they are then reduced to about one-seventh or eighth part of their bulk. His hogs supply him with such a considerable quantity of manure, in addition to that of his farm-yard, as will enable him to maintain a constant rotation of potatoe and light corn crops: his expense in machinery is small, and the waggon that carries his flour to market brings back his coals, his groceries, and his household requisites, without additional expense. It would be necessary for him to have a considerable number of labourers, and it would be his interest to attract them around him, by allowing them a small portion of land; and by being himself the purchaser of their superfluous produce, he would speedily raise a colony about him; and as the source which gave it life is connected with our subsistence, and the just necessities of our nature, coeval with our wants, its prosperity must be ensured so long as we continue in the disposition to supply them. In the general complaint of the scarcity of farms, and the high rents which lands at present bear, perhaps no speculation offers stronger inducements to the young farmer, who can command a moderate capital, and who is contented to forego some of the gratifications of a large society. If he possesses activity and enterprise, and has engaged his land upon the favourable terms upon which it ought to be had at a distance from market,

market, his success in a few years will be certain, provided the system meets with support from the public.

One of its many advantages consists in the incorruptibility of the farina; it is not like the flour of wheat, liable to decay, but it may be preserved for years sound and good, perhaps improved, but certainly uninjured by age. Thus our supply will be at all times rendered more equal, and the year of abundance will more effectually contribute to alleviate the year of scarcity: scarcities themselves are likely to be of less frequent occurrence, as we should have the advantage of two essential crops instead of one; and the weather injurious to wheat is not unfrequently favourable to the crop of potatoes, and *vice versâ*. I must also observe, that the farina forms an excellent ingredient in sea-biscuit, in the proportions of two parts of farina to three of wheaten flour, or even of three parts farina to four of wheaten flour; a composition of this sort is more likely to resist the effects of climate, from the incorruptible property already mentioned, than if the biscuits were wholly made of wheaten flour.

Such are some of the more leading advantages likely to be produced by the proposed introduction of the flour of potatoes into bread, and the change of system to which it would give rise. We are now, perhaps, on the eve of another alteration in the Corn Laws, calculated to render the present high prices perpetual. A Committee is sitting upon them, composed of men of landed property; and, I have heard, that it is in contemplation to prevent the importation of foreign wheat when the price of British wheat is under 96*s.* *per* quarter. This, then, is peculiarly the moment to introduce an alteration in the system, which would render such a measure unnecessary, and which, instead of perpetuating high prices, would produce amongst us all the blessings of plenty. They

may

may be summed up in these words: We shall have a greater regularity, and a certain reduction of price; an immense increase of consumable food; its more equal distribution through years of scarcity and years of plenty;

A consequent diminution of the poor's rates;

An increase of comforts to the poor, and to all classes of society, and a great accession to our resources in every branch of national wealth.

April 29, 1813. J. WHATELY.

EXPERIMENTS ON BREAD.

First Experiment.

No.	Weight.		Materials.	Pr.	Amount.		Weight of Bread		Cost per lb	Observations.
	lb.	oz.		d.	s.	d.	lb.	oz.	d.	
1.	2	8	Flour	5¼	1	1⅛	3	6	3⅞	Good bread.
2.	2	0	Flour	5¼	0	10½	2	11	3⅞	The same.
3.	1	8	Flour	5¼	0	7⅞				
	1	0	Farina	3	0	3				
	2	8			0	10⅞	3	4	3⅜	Raw potatoe flavour.
4.	2	0	Flour	5¼	0	10½				
	1	0	Farina	3	0	3				
	3	0			1	1½	3	13	3½	The same.
5.	1	8	Flour	5¼	0	7⅞				
	2	0	Farina	3	0	6				
	2	0	Boiled Potatoes	0½	0	1				
	5	8			1	2⅞	5	7	2¾	Slight flavour of the raw potatoe; crust soft.
6.	1	8	Flour	5¼	0	7⅞				
	1	0	Boiled Potatoes	0½	0	0½				
	2	8			0	8⅜	2	9	3¼	Well tasted bread; moist.

First Experiment, *continued.*

No.	Weight lb.	Weight oz.	Materials.	Pr. d.	Amount. s.	Amount. d.	Weight of Bread lb.	Weight of Bread oz.	Cost per lb d.	Observations.
7.	2	0	Flour	$5\frac{1}{4}$	0	$10\frac{1}{2}$				
	1	0	Boiled Potatoes	$0\frac{1}{2}$	0	$0\frac{1}{2}$				
	3	0			0	11	3	0	$3\frac{5}{8}$	Well tasted bread; moist.
8.	1	0	Flour	$5\frac{1}{4}$	0	$5\frac{1}{4}$				
	1	0	Farina	3	0	3				
	1	0	Boiled Potatoes	$0\frac{1}{2}$	0	$0\frac{1}{2}$				
	3	0			0	$8\frac{3}{4}$	3	2	$2\frac{3}{4}$	Excellent bread: I consider it fully as satisfying as bread made wholly of wheaten flour.
9.	1	0	Flour	$5\frac{1}{4}$	0	$5\frac{1}{4}$				
	1	0	Boiled Potatoes	$0\frac{1}{2}$	0	$0\frac{1}{2}$				
	2	0			0	$5\frac{3}{4}$	1	13	$3\frac{1}{8}$	Baked heavy, but very sweet bread; moist.

Second Experiment.

No.	Weight lb.	Weight oz.	Materials.	Pr. d.	Amount. s.	Amount. d.	Weight of Bread lb.	Weight of Bread oz.	Cost per lb d.	Observations.
1.	2	0	Flour	$5\frac{1}{4}$	0	$10\frac{1}{2}$				
	1	0	Boiled Potatoes	$0\frac{1}{2}$	0	$0\frac{1}{2}$				
	3	0			0	11	2	$15\frac{1}{2}$	$3\frac{3}{4}$	Baked heavy, but not unpleasant bread.
2.	1	8	Flour	$5\frac{1}{4}$	0	$7\frac{7}{8}$				
	2	0	Farina	3	0	6				
	2	0	Boiled Potatoes	$0\frac{1}{2}$	0	1				
	5	8			1	$2\frac{7}{8}$	5	6	$2\frac{3}{4}$	Baked heavy; indifferent bread.
3.	2	0	Flour	$5\frac{1}{4}$	0	$10\frac{1}{2}$				
	2	0	Farina	3	0	6				
	2	0	Boiled Potatoes	$0\frac{1}{2}$	0	1				
	6	0			1	$5\frac{1}{2}$	6	0	$2\frac{7}{8}$	Excellent bread; improved by being kept a few days, rather overbaked.
4.	1	8	Flour	$5\frac{1}{4}$	0	$7\frac{7}{8}$				
	1	0	Farina	3	0	3				
	1	0	Boiled Potatoes	$0\frac{1}{2}$	0	$0\frac{1}{2}$				
	3	8			0	$11\frac{3}{8}$	3	5	$3\frac{1}{2}$	This proportion is perhaps superior to the last, but the bread of both is excellent; improved by being kept a few days.

No.

Second Experiment, *continued.*

No.	Weight.	Materials.	Pr.	Amount.	Weight of Bread	Cost per lb	Observations.
	lb. oz.		*d.*	*s.* *d.*	lb. oz.	*d.*	
5.	1 0	Flour........	$5\frac{1}{4}$	0 $5\frac{1}{4}$			
	1 0	Farina........	3	0 3			
	1 8	Boiled Potatoes	$0\frac{1}{2}$	0 $0\frac{3}{4}$			
	3 8			0 9	3 3	$2\frac{7}{8}$	Rather too moist, but very sweet and good, and much improved by keeping.
6.	1 0	Flour........	$5\frac{1}{4}$	0 $5\frac{1}{4}$			
	1 0	Rasped Potatoes	$0\frac{1}{2}$	0 $0\frac{1}{2}$			
	2 0			0 $5\frac{3}{4}$	1 12	$3\frac{1}{4}$	Light pleasant bread; dark coloured.

Third Experiment.

No.	Weight.	Materials.	Pr.	Amount.	Weight of Bread	Cost per lb	Observations.
1.	2 0	Flour........	$5\frac{1}{4}$	0 $10\frac{1}{2}$			
	2 0	Farina........	3	0 6			
	2 0	Rasped Potatoes	$0\frac{1}{2}$	0 1			
	6 0			1 $5\frac{1}{2}$	6 2	$2\frac{7}{8}$	Heavy; discoloured; made from potatoes rasped 48 hours; flavour not pleasant.
2.	2 0	Flour........	$5\frac{1}{4}$	0 $10\frac{1}{2}$			
	2 0	Farina........	3	0 6			
	2 0	Boiled Potatoes	$0\frac{1}{2}$	0 1			
	6 0			1 $5\frac{1}{2}$	6 1	$2\frac{7}{8}$	Heavy.
3.	1 8	Flour........	$5\frac{1}{4}$	0 $7\frac{7}{8}$			
	1 0	Farina........	3	0 3			
	1 0	Rasped Potatoes	$0\frac{1}{2}$	0 $0\frac{1}{2}$			
	3 8			0 $11\frac{3}{8}$	3 9	$3\frac{1}{4}$	Rather heavy; discoloured; the boiled potatoes are evidently a more desirable ingredient than the rasped.
4.	1 8	Flour........	$5\frac{1}{4}$	0 $7\frac{7}{8}$			
	1 0	Farina........	4	0 3			
	1 0	Boiled Potatoes	$0\frac{1}{2}$	0 $0\frac{1}{2}$			
	3 8			0 $11\frac{3}{8}$	3 5	$3\frac{1}{4}$	Good bread; toasts extremely well; indeed all bread made of a proportion of potatoe is remarkably good toasted.

Third Experiment, *continued.*

No.	Weight. lb.	oz.	Materials.	Pr. d.	Amount. s.	d.	Weight of Bread lb.	oz.	Cost per lb d.	Observations.
5.	2	0	Flour.........	5¼	0	10½				
	1	0	Farina........	3	0	3				
	1	0	Rasped Potatoes	0½	0	0½				
	4	0			1	2	4	0	3½	Rather heavy; discoloured; flavour not good.
6.	2	0	Flour.........	5¼	0	10½				
	1	0	Farina........	3	0	3				
	1	0	Boiled Potatoes	0½	0	0½				
	4	0			1	2	4	0	3½	Excellent bread; superior in colour to No. 4, and rather more compact; this quantity of wheaten flour alone, as appears by No. 7, would have produced 2lb. 10oz. of bread; consequently the actual proportion of the produce of the potatoe in this loaf is 1lb. 6 oz. or, as nearly as possible, one-third.
7.	2	0	Flour.........	5¼	0	10½	2	10	4	Rather dark; the appearance of this loaf indicated that the yeast used for this batch was not good.
8.	2	0	Flour.........	5¼	0	10½				
	0	8	Farina........	3	0	1½				
	2	8			1	0	3	4	3¾	Excellent bread; whiter than bread made of wheaten flour alone; no flavour whatever of potatoe; not used until nine days old.
9.	2	0	Flour.........	5¼	0	10½				
	0	8	Farina........	3	0	1½				
	0	8	Rasped Potatoes	0½	0	0¼				
	3	0			1	0¼	3	7	3½	Not equal to No. 10, an additional proof that rasped potatoes are not desirable.
10.	2	0	Flour.........	5¼	0	10½				
	0	8	Farina........	3	0	1½				
	0	8	Boiled Potatoes	0½	0	0¼				
	3	0			1	0¼	3	5	3¾	Excellent bread; rises by toasting; and was quite fresh at seven days old.

From

From these experiments it appears that various proportions of potatoes and farina are highly palatable in bread; but if it be calculated that not more than one-fifth part be generally introduced into consumption, the operation of that fifth is sufficiently great to produce all the effects in view, in recommending its general adoption.

Some kinds of potatoes contain a much greater proportion of farina than others, some yielding a seventh part, and even a still larger proportion of it. Experience will best determine the most desirable sort for use, as other kinds produce more abundantly in number; all these considerations should be attended to.

Potatoes may be manufactured into farina during the greater part of the year, but they lose a portion of their farinaceous matter when vegetation begins; the manufacturer, therefore, should provide an early sort to commence his operations upon in August, and cease to grind any after the months of April and May.

Frost-bitten potatoes yield nearly as good farina as the others, provided they are ground before they begin to decay; and potatoes kept over for a whole season, although of inferior value, may by this process be still rendered serviceable food for mankind. These are advantages which ought not to escape notice. Frost-bitten potatoes have hitherto become in a short time a total loss, and farmers have generally been afraid of extending their cultivation of potatoes, for fear of their being spoiled by keeping, both which inconveniences are avoided by preparing the farina from them.

Amongst the many important uses to which the farina may be applied, that of biscuit for sea store is of great consequence. Biscuits made from one part farina and two parts of wheaten flour are whiter and better than those made wholly of common flour. Baked biscuits of these

these proportions have been repeatedly made with uniform success, and as the farina is in itself less corruptible than wheaten flour, it is likely to produce a biscuit of a less perishable kind. Some have been already kept nearly twelve months without exhibiting any symptoms of moisture or decay; on the contrary, they were as hard and as good as on the day they were baked. Biscuit differs from leavened bread in this circumstance, that all moisture is evaporated from biscuits in baking, whilst it constitutes an essential quality in bread; the weight of bread is greater, the weight of biscuit is less than the flour of which it is composed; it is, therefore, not inconsistent with the nature of farina that it should exhibit more moisture in bread, and yet discover no symptom of it in biscuit; and it has one convenient property, of which a baker, who manufactures it, may avail himself, that it may be used for bread or biscuit either in a wet or dry state, consequently the expense of drying it may in some cases be avoided. Its introduction into biscuit would produce a saving of one-third of the wheaten flour now used for that purpose, which will be found very great, when the extensive use of biscuit in the navy and army is considered. The farina of potatoes should constitute, from its general application, a part of the stores of each.

In the navy particularly, the farina would afford a great variety of food, as it forms an excellent ingredient in soup as a substitute for pease, oatmeal, and rice, and possesses the superior advantage over those substances, of not being susceptible of injury. One ounce of farina will thicken sufficiently nearly one quart of water: and when this soup is flavoured with onions, celery, leeks, &c. and seasoned with pepper and salt, it forms a very palatable mixture without the aid of meat. The produce of twenty-one pounds of raw potatoes made into farina, and soup

formed

formed from it, will furnish a wholesome meal to twenty-eight persons, allowing each person a full quart, which potatoes, in their original state, would scarcely furnish a dinner to one-third of that number.

The farina of potatoes will form a thick mucilage, with twenty-six times its weight of water.

In all cases where the farina is intended to be converted into a gelatinous state, the farina should be previously mixed with some portion of the liquid cold.

A desert spoonful of the farina mixed with a little cold milk and salt, and added to a pint of boiling milk, and kept stirring and simmering, will form an excellent nutriment.

From various circumstances, it appears that the article called Semolina in the shops, and recommended as a nutritious diet for children and sick persons, is wholly composed of the farina of potatoes.

Certificates.

Mr. Whately, of Cork, has shewn me a specimen of flour made from potatoes; and also of biscuit, made partly from this flour, and partly from the flour of wheat. I am convinced that this flour is very wholesome and very nourishing, and may be of great use to the public in supplying the deficiency of wheaten flour.

Lower Grosvenor-street, M. Baillie, M. D.
Dec. 11, 1812.

I have examined the flour from potatoes made by Mr. John Whately, and have no doubt of its containing all the nutritious part of the potatoe, and therefore calculated to form a very good and valuable diet; and as the flour thus produced may be readily transported to any distance, and may be kept for a very long time without losing

losing any of its nutritive properties, I think the conversion of potatoes into flour may prove highly advantageous to the community.

Soho-square, Jan. 17, 1813. GEO. L. TUTHILL.

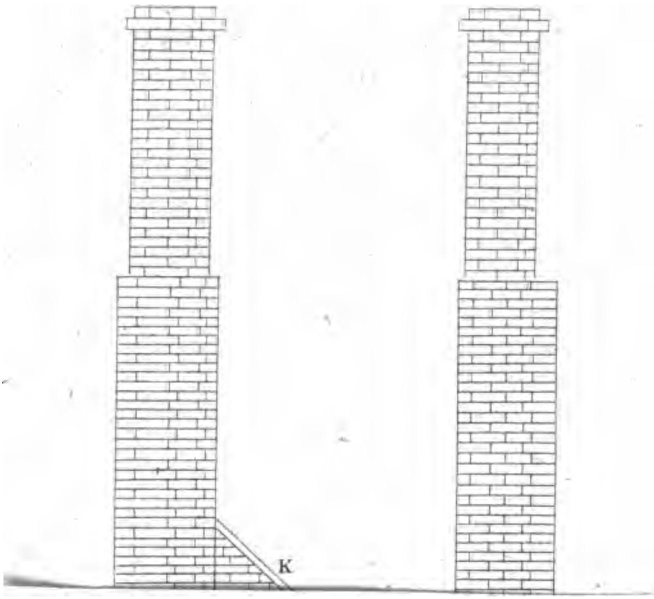
REFERENCE TO THE ENGRAVINGS.

This machine is of a very simple construction, its moving part consisting of a cylinder covered with tin plates, pierced with holes, so as to leave a rough surface, in the same manner as the graters used for nutmegs, &c. but the holes in this are larger. This cylinder is situated beneath a hopper, into which the potatoes are thrown, and thence admitted into a kind of trough, where they are forced against the cylinder, which as it revolves grinds the potatoes to a pulp.

Fig. 1, (Plate XV.) represents the machine in front, or lengthways of the cylinder; and Fig. 2 is a section through the middle of it, shewing also the hopper with its contents, and the manner of the action of the machine. A, represents the handle, by which motion is given to the machine: it is fixed upon the end of the axis of the grating cylinder B, on the opposite extremity of this axis is a fly-wheel C, to regulate and equalize the movement. D is the hopper, into which the potatoes are put; and pressing by their weight upon the top of the cylinder as it revolves, they are in part grated away. On one side of the lower part of the hopper is an opening, closed or opened more or less at pleasure by a slider E; and the degree of opening which this has regulates the passage of the potatoes from the hopper D into the trough F: this is as wide as the length of the cylinder, and has a concave board G fitted into it, which slides backwards and forwards, by the action of levers *a a* affixed to an axis H, extended across the frame of the machine.

mnd Series.

Mr. Lewis's [illegible]



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fixed to an axis H, extended across the frame of the machine.

machine. K is a lever fixed upon the middle of this axis, and terminating in a hook at the end for the suspension of a weight L; this acts upon the board G by means of the levers K and *a a* and the rods *b*, to force or press the potatoes contained in the trough forwards against the cylinder, and complete the grating of them into a pulp.

A line *c* is tied to the end of the lever K, and passing over a pulley *d*, hangs down within reach of the person who turns the handle of the machine: by drawing this line the weight at the end of the lever K is raised up, and by the rods *b* the board G is withdrawn to the extremity of the trough, and a fresh stock of potatoes falls out at the opening E from the hopper into the trough; then, the line being let go, the weight L presses the board against the potatoes, and forces them against the cylinder, which by its motion grates them away very rapidly, the pulp passing down the space between the edge of the lower board of the trough F, and the cylinder, which space is only a narrow crevice that nothing may pass down but the reduced pulp, which falls into a box or vessel situated between the frame at M. The board G is perforated with a number of large circular holes, to make an uneven surface, in which the potatoes remain steady, whilst exposed to the action of the cylinder upon their opposite sides.

The tin plate covering the cylinder is of course pierced from the inside outwards, and the bur or rough edge left round each forms an excellent rasping surface, for the reduction of such substances as the present. The frame of the machine requires but little explanation, merely consisting of a square frame, containing the cylinder, and supporting the hopper. This frame stands on four legs, two of which rise up to a sufficient height to carry the pivot of the axis H. The legs are morticed into four

 ground

ground sells, which may be made to receive a box or chest, fitted in the manner of a drawer, to contain the pulp as it falls from the machine, or it may fall into any vessel placed underneath.

The pulp in the vessels in which it is collected should be completely immersed in water, and well stirred, the separation of the farina, by its falling to the bottom, will speedily take place. The fibrous and refuse parts should be first removed, and the farina afterwards repeatedly washed, until it no longer communicates any tinge to the water: it is then sent to the stove or drying apartment, put into boxes, and dried. Care should, however, he taken, that it does not dry too rapidly. Wherever the business is conducted upon a large scale, a machine for washing the potatoes * should be erected, and it might be contrived to receive motion from the power that directs the grinding machine. The vessels containing the pulp should be so arranged, that a stream of water could be made to pass through them at pleasure. The pulp, after the first separation of the farina, still retains a quantity of farinaceous matter; but it will, perhaps, be more profitable to convert it into food for hogs, with such other additions as may be thought necessary, than to steep it again for the purpose of extracting any remaining portion of farina. It will be probably best to give it to the hogs boiled, along with a moderate proportion of boiled potatoes. This disposal of the refuse pulp would nearly defray the whole expense attendant upon the manufacture of the farina.

*** This machine would operate with good effect for reducing apples to a pulp for making cyder, as it is extremely expeditious and effectual in its operation.

* Models of two machines proper for washing the earth from potatoes may be seen in the Society's repository.

Mr.

Mr. White, *of Woodland, in the County of Durham, during a Correspondence with the Society of Arts, having informed the Secretary, that his deceased Father had been favoured with Nine Gold and Two Silver Medals from them, for planting the Trees he is now converting to a valuable Purpose; the Society thought it would render an essential Service to the Public, to trace the Progress of the Trees, from the Time of their being planted to that of the Application of their Bark for tanning; and therefore directed the Secretary to make the necessary Inquiries for that Purpose from Mr.* White; *in answer to which the following Communication was received.*

From the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce.

Sir, *Woodlands, Sept.* 10, 1813.

I AM favoured with your's, containing a number of queries, which you request me to answer, by giving an account of the formation and progress of my plantations at this place; an undertaking I shall enter into with very great pleasure, and be equally glad if the humble production of my pen meets with the approbation of the Society, and is found useful to the public; but, I must observe, that, after the correct description given by my late father, in two letters addressed to them, one dated January 31, 1786, which is inserted in their fifth volume, and the other August 30, 1796, it will not be in my power to make a statement of his proceedings without being liable to repetition.

In answer to the first part of your inquiry, I must observe, that the trees, for which he was honoured from the

the Society with nine gold and two silver medals, were not planted by themselves, but intermixed, which mode was adopted from an idea, that as different species seek their nourishment at various depths and levels, a greater number could be raised on any given surface of ground, and at the same time afford much more beauty to the eye; which, in my professional employment of laying out grounds, is a principal study. But although these trees have been scattered over the face of the plantations, the better half being composed of resinous kinds, such as larches and firs, this peculiar attention was paid to them, *viz.* that where the ground promised to suit any particular hard wood tribe, it was consequently planted in greater numbers; but, first from the tyranny of the Scotch firs, and latterly that of the larches, many, where the ground was less favourable for them, have been overpowered, which it was almost impossible to prevent, from the great number planted upon an acre, some at two feet, and others at three; whereas now we find four feet and a half asunder quite near enough.

Notwithstanding the reasons given for planting promiscuously, it is certainly right to consider, in a great measure, what trees are most suitable for sale in the country, as well as the quality of the ground; should the latter not be proper for oaks, which are doubly valuable, in every situation, in most of which, however rich the surface may be, or sheltered by Nature, it is necessary to plant larches and firs for nurses, as deciduous trees grow much faster when protected by the foliage of these hardy foresters, which can afterwards be partly or wholly cut away, as may be found most conducive to the interest of the proprietor.

The surface soil, which you inquire about, is in some parts of a sharp sandy nature, and in others rather channelly

nelly to the depth of four or five inches, the top inclining to a blacker mould, and the under stratum composed of a grit-stone rock.

Other places are nearly of the same description, only of better quality, and some parts in the low grounds are furnished with a tolerable depth of earth, which the progress of the trees easily points out; for on the bare and worst ground nothing but larches, firs, and birches thrive, and consequently not only these do better on land of the same description, but also here and there others; whereas, on the last-mentioned soil, oaks, elms, ashes, beeches, &c. have shewn an inclination to grow as luxuriantly as the resinous sorts, and which are protected with the greatest care, and even the larches cut down to make way for them, but as the Scotch firs are almost exterminated, the larches are certainly the prevailing trees in my plantations.

In answer to your question, When the planting operations began here? I think it was about the year 1776, which were completed in a very few years afterwards?

The holes were made with a hollow spade, invented, with many other tools, by my late father, which are thus much sooner done than by the common method, and the trees planted shallow in the ground, deep planting being the bane of great numbers.

Particular attention was also paid to their roots, which if fibrous and vigorous, the fine appearance of the tops were of little consequence, and therefore the heights of the trees were chosen to suit the exposure, as well as quality of the soil. But notwithstanding the length of time that planting has been practised, scarcely one person in ten, in my humble opinion, puts in trees small enough, being anxious to gratify the eye with a sight of the tops, without considering, that, perhaps, if of the hard

hard wood species, they will make little or no progress till cut down, and allowed to spring up again.

So very different were those planted here, that a party of neighbouring people, after visiting the place, and riding through the plantations, began to inquire where they were, never supposing that the little pigmies under their horses feet were trees, and would raise towering heads to the height they have already attained.

As this plan succeeded so well on my estate at Woodlands, it has been strongly recommended by us to those employers who only took our advice in the decoration of their grounds, but planted for themselves; and in all our planting contracts, the whole of which amount nearly to 5000 acres, we never deviated from the mode above alluded to, and the rules which I shall mention in some other parts of this letter.

Many reasons are given for planting trees large out of a nursery; but I scarcely ever saw a spot that I thought was not better adapted to a tree of ten, twelve, or eighteen inches high, than above those sizes; there are, however, situations, such as old woods, and very sheltered places, where oaks and some other trees may be used, three, four, or even five feet high, but such ought to be removed in a nursery two or three times, to create roots equal to the length of lever above, prior to being planted in the places alluded to.

As, in exposed situations particularly, the deciduous kinds of forest trees will not get up without the aid of nurses, such as larches and firs; these should be planted smaller than the objects they are to protect, particularly Scotch firs, not only to enable them to bear the winds that may annoy them in the infant years, but also on account of their roots not being so well furnished with fibres. The ages of the Scotch firs, therefore, should be only one

year

year transplanted, *viz.* three years old, larches and spruce firs, three and four years; and the hard wood kinds, three, four, and five years old, just to suit the situations which they are to be removed to, and the progress they have made in the nursery, always keeping in mind, that the smaller the trees the sooner they will get footing in the ground and shoot up.

In land of a poor quality, such as mine, the kinds of trees proper to be first planted may be as follows; *viz.* larches one-fourth, Scotch firs the same, and the rest of the ground filled up with birches, alders, oaks, ashes, and elms, in such proportions as the ground may direct, by being of a moist or dry quality, &c.

I must now beg leave to mention, that a practice prevails very much in good soils, of cutting the grass in plantations, either for some needy cottager's cow, or from an idea of its hurting the trees, which method I always oppose with all my might, being fully of opinion, that trees, in an infant state, receive great benefit from the shelter, and that infinitely more are destroyed by the hook, than by the weight of grass lying upon them, which will in general only injure a few larches and firs, where it is coarse, and the land wet, for want of draining.

In answer to that part of your letter relative to the propriety of cultivating ground, before planting, by trenching, digging, or ploughing, I must say, that it certainly has a good effect to follow some of those schemes on clayey bottoms, or in such ground as inclines thereto; and, it is a farther advantage, to keep it pretty clear after being planted, by introducing amongst the trees a crop of potatoes, and hoeing it for two years after; but all this latter treatment is supposed to be in the most ornamental parts of pleasure grounds, and probably on land of no very great extent. But with respect to such a subject as mine,

mine, I am pretty certain, so much expense in digging or ploughing may be saved, and the trees thrive equally well, as I see no progress that they have made where the ground was ploughed, more than in that which was planted in its natural state amongst the wild native heath; and although several acres were trenched, I think the principal advantage which the trees have gained, is in part owing to the superior goodness and depth of soil, where such trenching has taken place, and from being made sheltered. But, notwithstanding what I have advanced, I have seen, particularly in the north of Scotland, very bad land that would receive infinite benefit if it was ploughed or trenched so deep as to perforate a close stratum of hard substance, so retentive as to hold water like a dish, and which, if not broken, will never permit the roots of the trees to descend below it; consequently, for want of this precaution and necessary expenses, they are frequently blown down long before they arrive at maturity. In general, this obdurate substance is within reach of the plough, but sometimes deeper, and runs through very large tracts of country, like any mineral substance.

I have before mentioned, that all the trees were planted here in holes made with a hollow spade, but larches and firs are often put in, by other persons, by making two slits with the common spade, so as to form two sides of a square, and, after lifting up the sod, which of course is fast on the other two sides, treading it down upon the plant; this is much sooner done than by digging holes, and in very light and sandy soils, where it is an advantage to disturb the surface as little as possible, this method does very well.

I am happy to have it in my power to answer your letter relative to the value of the wood when cut down, by stating,

stating, that last year I took an under-rated average of the growing timber, which made each acre to contain 480 trees, and each tree one cubic foot and three quarters of wood, the value of which, at the low price of two shillings *per* foot, would amount to 84*l.* sterling an acre, exclusive of the bark, which, at the present price of eleven guineas *per* ton, is equal to a third part of the timber, supposing the trees were all larches:—In this estimation some of them did not contain above one foot, whilst others measured eight, ten, and twelve feet, and which are growing upon land that only cost one and two guineas an acre, and in order to find out pretty correctly the progress that larch trees make, which we formerly thought would double their size every eight years, I selected six which were from fifty to sixty feet high, and measured the contents by the circles each year's growth produces, and the following was the result.

At ten years old every tree was supposed to consist of one part; at thirteen years and a half the average area of each section was twice as much; at eighteen years four times as much; at twenty-five years and one quarter eight times as much; and at thirty years old, when they were cut down, twelve times as much as at ten years old, which therefore doubled their growth every six years, and six other trees I took an account of at Lindertis, in the county of Angus, (whilst employed there a year ago in my profession of laying out grounds,) and which grew upon much better soil than mine, measured as follows; *viz.* from ten to thirteen years and one quarter, they were twice the size; at eighteen years and three quarters four times as much; at twenty-five years and three quarters eight times as much; and at thirty-three years and one quarter, when cut down, they were twelve times as large as at ten years sold; so that in twenty-three years and one quarter

quarter they doubled themselves three times and one-half, *viz.* every six years and three quarters. And, in order to shew how very correctly this mode of calculation agrees with the measurement of living trees, I have for some years back kept an account of several larches, which I numbered for the purpose, taking the girth at six feet from the ground, seven of which trees in the winter 1809 contained seventeen feet two inches six eighths; and at the end of the two following years their measurement was twenty-two feet eleven inches nine eighths, since which period they and several others have increased pretty much about the same ratio; but as the said trees are every year adding to their height, the increase is evidently more than what I have stated. From the best information I can obtain to the inquiry you make about the elevation of Woodlands above the sea, and the distance from it, the former is six hundred feet, and the latter twenty miles.

In regard to the question you ask, about what time these plantations were first thinned? I think it would probably happen ten years after planting, but this business always depends upon the progress of the trees, which in sheltered situations will require the axe sooner; and the true guide to ascertain the number to be taken out each time, is, to free every tree that is to remain from the lashes of its neighbour's tops, weeding out the worst first, and always keeping in mind which trees are to stand ultimately.

In a country where hedge-stakes are wanting, or fuel scarce, which this work consists of, the expense will nearly be paid.

The second thinning took place about eight or ten years after, or at eighteen years growth, being as soon as the trees began to touch each other again; which produce

duce was found useful for coal-baskets, pit-props, and crate-wood, as used in glass-houses, besides being of service for many purposes in the lead-mines, &c. &c. this, therefore, not only paid the expense, but began to make some return from the original cost of planting the trees, &c. At the end of the next six or eight years, when they began to annoy each other again by their proximity, many were large enough for buildings, in addition to the uses before alluded to; and at the next thinning, which is now going on, I sell them as rails for coal-waggons to run on, for timbering and flooring larger buildings, for fence railing, &c.; and the larch, which I am happy to say rises in estimation daily, is not only used by others in the great variety of ways before mentioned, but by myself for some works in husbandry, where ash was before resorted to, *viz.* for making the entire bodies of waggons, and even blocks and poles, where the greatest toughness is required to carry heavy burthens. These waggons possess both lightness and durability, and answer perfectly well. I also find the larch to remain sound in the ground, when the small sized oak which is laid near it, and at the same time, as the bottom rail of a coal-waggon way, is going to decay, which perfections are in wood that will attain much greater strength as the trees increase in size.

This last thinning is supposed to leave the trees at timber distances, *viz.* 12, 15, and 18 feet asunder, which I think far enough to allow larches to arrive at large dimensions; whose roots, when each tree is allowed sufficient room, will occupy as much extent below ground as the branches do above.

Pruning.

With respect to your observations about pruning, I see it so very often put in practice, upon hundreds of

trees that ought to be cut down, and so wretchedly performed where it might be of use, that I am afraid more mischief has been done than good by the application of it, exclusive of the large sums thrown away; which makes me almost regret that so much has been written about it. I will, however, according to your desire, copy a few observations written by my late father, to a friend, a year or two before his death, on this subject, and that of shelter.

"Though much has been said against pruning, I must observe, that no planted wood can be made clear and brought to perfection without it, as trees properly planted and thinned will, by the room allowed, put out large branches, which, if left on, will in a timber state become great knots, and in the fir tribe in particular will make the timber of little value, and unsuitable for many purposes; certain it is, that this work is often performed very improperly, so as to prevent the growth of the tree, by divesting it of too many branches, and thus injuring the circulation of the sap, for which purpose the foliage of the tree is by nature intended."

"Others, in pruning, leave stumps standing out several inches from the stem, which, when cut, die of course, and will remain on the tree till its annual growth laid on in circles, covers the whole; and when the tree arrives at timber, and is sawn up, the dead knots fall out, leaving a hole in each plank, which the workmen call dead knots; the method, therefore, which I should recommend is, to begin to prune some little time prior to each thinning, that the woodman may see more clearly what trees are to be taken down, at which time the branches of the fir kind will be small, and the knots consequently so; and those of the larch may be covered with a sixpence.

"To prevent dead knots, the amputation should be performed

performed close to the stem, which will heal in a very short time.

"The subsequent prunings may keep pace with the thinnings, it being a bad mode to defer that work, till the branches become large, or to do too much at one time; and regard ought always to be paid to leave a handsome top, which should be about two-thirds of the whole height.

"These prunings, as well as the tops of the trees taken down, after they have laid a year or two upon the land, completely banish the wild native heath, and bring up white clover, and other general grasses, which, added to the annual droppings of the larch, and other trees, have, in the course of twenty or thirty years, a good effect in deepening the soil, and preparing it for vegetation."

Shelter.

"This article I conceive to be of so much importance as not to be omitted, which is as essential to the growth of trees as the soil that produces them; as the greater the mass together the quicker they will grow, particularly in such situations where Nature has not provided shelter; which must appear evident by comparing rows, clumps, and small plantations, with extensive woods of the same ages; and as the West wind in all parts of this island is more prevalent than any other, there should be always in that quarter a formidable screen of the hardy resinous trees, such as firs and larches, which should be pruned no higher than the wall or hedge that surrounds them; and the article of thinning should only be so performed on that side as to prevent their growing into poles, which would divest the wood of that shelter you wish to encourage. In short, the western border should be so managed, as to make it subservient to the good of their more protected and prosperous neighbours; indeed, they will, by their

their slow growth to the West, require less pruning and thinning, for so severe is this wind upon trees, that even upon the eastern shore they lean from the West."

The orchard of eleven acres, which you mention in your letter, I am sorry I cannot give so good an account of; for, although the trees were planted facing the South, with large masses of wood all round, as the ground sloped quickly, it was rather too much exposed to the East and West winds, but particularly the latter, which came sweeping up the valley before the forest trees were high enough to protect them; which defect, in addition to the injury some of the fruit trees received in our absence, from the plough, both on their bark and roots, by careless drivers, induced us to take up the best trees, and plant them, large as they were, on a smaller scale, and on a spot more level and perfectly sheltered, where they are now producing very well. But in this northern climate, where we are very liable to untoward springs, fruit trees are often severely handled by frosts, which come on so very late as to make the produce very precarious, and to injure very much even the tender leaf of the larch, as well as other forest trees; it is, therefore, almost impossible to have an orchard too much sheltered by lofty hedges, rows of trees, &c. which are the only true ways to avoid disappointment and chagrin at the yearly loss of your fruit; as an example of the good effects of which, I know a cottager's orchard made out of an old gravel pit, so sheltered by hedges, bushes, and trees, as scarcely ever to fail, notwithstanding the barrenness of the soil.

I am, Sir,

Your most obedient humble servant,

To C. Taylor, *M. D.* THOMAS WHITE.
Sec. to the Society of Arts, &c.

On

On covering the Soil in Hot-beds, &c.

By Mr. HENDERSON, *of Berchin Castle.*

From the TRANSACTIONS of the CALEDONIAN HORTICULTURAL SOCIETY.

I. *Directions for covering the Soil in Hot-beds, Pineries, &c.*

FOR this purpose, lay on the surface *fine drifted river or sea sand, three inches deep.* This covering possesses many advantages. It will extirpate the *slater* or wood-louse, as the nature of the sand prevents the insect from concealing itself from the rays of the sun. In dung hot-beds it keeps down the steam. To fruit it affords a bed as warm and as dry as tiles or slates. This covering also retains the moisture in the earth longer than any other, and is itself sooner dry. It gives the houses a clean neat appearance; and though it cannot be expected to remove the infection where already introduced, will be found a powerful preventive of that great evil mildew.

II. *Observations on the sowing of early small Seeds.*

It appears to be a fact, that the produce of some small seeds is connected with the time of sowing. Six years ago I sowed on the flower border in front of our hot-houses about 140 different kinds of annuals, allowing to each a patch of earth, and tallying them. In the other borders and shrubbery I sowed the same kinds with equal care, and gave each patch about half a spadeful of compost dung. Of the first sowing, all the kinds grew except about five or six; of the second, not ten different kinds appeared in all our extensive borders. It happened, that, at the time of the first sowing, there was a field in the park laid down in grass, and, at the time of the second, another was laid down with equal care. In the

the first, the clover was complained of as too abundant; in the second, there was no clover at all, except about the head ridges. Sixteen years ago, I observed the very same result in an early and a later sowing of lucern. The natural course in these instances would be, to lay the blame on the seeds, and complain of the merchant; but it turns out, that the seed in these cases were taken from the same bags. There must, therefore, be some other cause of the failure of the latest sowing; and it will be found in the relation of the time of sowing, to the production of those insects which destroy the seed-leaf of the plant. Insects are not produced, as is vulgarly imagined, by the East wind, but proceed from eggs, chrysalides, &c. deposited the former year. At certain seasons, provided the weather is warm, these insects are produced in astonishing numbers.

It is worthy of observation, that plants suffer most severely when frost succeeds a few days of warm weather. The warmth first hatches the insect; the cold checks vegetation, and retains the plant in the seed leaf; and by this is the young brood supported. In weather of this sort the annual weeds of the same age with these early plants will be observed in the same manner perforated and cut down.

An angler must imitate the flies which are hatched at their respective seasons; and on his attention to this branch of his art depends in a great measure his success. As different insects are hatched at different periods in the season, it will be of advantage to regulate the time of sowing in such a manner, that the vegetation of the seed, and the birth of its enemy, may not meet together.

In all the cases above mentioned early sowing was advantageous. There are crops, however, which do not admit

admit of this precaution, and for them proper antidotes are to be sought. In turnips, which are so frequently lost in the seed-leaf, I have found, that the expedient of dusting the ground with soot, deserves more attention than it receives. It should be employed in a damp morning; and when rain falls soon after the operation, it will be needful to go over the ground a second time. For field turnips, a box might be fixed on the roller to sow the soot with the seed, or a machine might be formed for dusting the plant when it is in the seed-leaf. For garden turnips, the best machine is the hand.

Remarks on the Construction of Hot-house Flues.
By Robert Stevenson, *Esq. Civil Engineer.*

From the Transactions of the Caledonian Horticultural Society.

I beg to communicate to you, for the information of the Horticultural Society, the particulars of an experiment, made some years since, with a view to the heating of drying-houses, for the purposes of bleachers and manufacturers; being of opinion that the same principle may be usefully employed in the heating of stoves, vineries, &c. in gardens.

The apartment in which the experiment was made measured fifteen feet in length and nine feet in breadth, upon the floor. The fire-place was at one end, and the fuel was suppplied on the outside of the walls. From the fire thus situated, a flue, six inches by ten inches, was conducted under a floor of tile-brick: this flue was made to cross under the floor several times, before it reached the chimney, at the farther end of the room. By this means the smoke and heat were longer detained in their passage to the chimney; and being made to traverse the

whole of the floor, it was confidently expected that the temperature of the apartment would be speedily raised to about 100 degrees of Fahrenheit. The result, however, proved otherwise, for it was with considerable difficulty that a temperature of from 60° to 70° could be maintained.

The flues were then removed, and cross walls erected in their places, for supporting the floor. These cross walls were of open brick-work, so that the whole space under the floor formed one large flue for the smoke and heated air. After making this alteration, the same quantity of fuel was put into the same fire-place, as before, and the temperature was speedily raised to 150°, at which it could be maintained for any length of time, with the ordinary expenditure of fuel.

I was some time since applied to by Messrs. Rennie, Airth, and Company, of Arbroath, (who are extensively concerned in the bleaching of yarns,) regarding the heating of a new drying-house, which they had just erected. It was stated, that their former drying-house was much smaller than the new one, and that with two fires and flues, constructed in the ordinary way, so much difficulty was experienced in producing a sufficient degree of heat, that they were afraid even a third fire, in very cold damp weather, might be found necessary, on account of the larger dimensions of the new house.

Upon visiting the works, I found the walls of the house so far advanced as to be ready for the roof. It is situated at one end of a plot of grass land, unconnected with any other building, and therefore exposed on all sides to the weather. I recommended that the earth within the house should be excavated to the depth of four feet, which was as low as the foundation of the walls had been carried. When this was done, a fire-place was opened at one end

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of the house, and a flue was carried to the other end, when it turned, and was brought down the middle of the floor; and, after being conducted a second time to the end of the house, opposite the fire-place, it communicated with a chimney which carried off the smoke. This flue, measuring three feet in height and two feet in breadth, makes its evolutions in a space equal to the area of the building, and four feet in depth under the sole of the door. The flues were, therefore, not only much larger than is common, but as the division walls for supporting a pavement-floor over the flues were all made of open brick-work, the whole space above described was thereby converted into one large flue, or chamber, for heated air, which is made to issue from the open joints left between the pavement-stones of the floor, and circulates freely to every part of the interior of the building; so that with one common fire the temperature of this drying-house, whose area measures thirty-five feet by eighteen feet, and fourteen feet in height, from the ground floor on which the flues rest, is speedily raised to, and easily maintained at, from 70° to 90° of Fahrenheit, while hung full of wet yarn, and while the shutters in the upper part of the walls are set open, to allow the steam arising from the process of drying the yarn to escape. This effect, which is much greater than could be produced in the old drying-house belonging to the same gentlemen, although of much smaller dimensions, and heated wih two fires, is to be ascribed entirely to the larger flues of the new hcuse.

It therefore appears, that the simple application of as large flues as the circumstances of hot-houses will admit, would not only be attended with much advantage in point of economy, as a very small fire would be sufficient to maintain the temperature usually required in hot-houses;

but, what perhaps is of more consequence, flues properly constructed upon this principle can be easily regulated, and will induce a much more uniform degree of heat. It seems from this experiment, that the flues in general use are of too small dimensions, that there is not capacity in them for allowing the heated particles of air to expand, and that the heat passes through the narrow flues, and makes its escape with the smoke in a latent state, without being allowed to act upon a surface large enough to rob it of its caloric.

Upon this principle churches and large halls might be heated; and one fire might be made to heat a much greater range of vineries than is in practice at present: it would also be a great improvement in the construction of hot-houses, and even of garden inclosures, to make the walls hollow *, as well on account of such a construction inclosing a space of air, which is an excellent non-conductor, as of the facility with which a fire may be applied, by converting the whole, or greater part, of the wall into a flue or receptacle for heated air. When this is to be done the fire-place should be kept as low as possible; and, after answering its purpose in the hot-house, the flue might be made to communicate with the hollow garden-wall, and the smoke made to escape at a chimney situated, according to circumstances, at a greater or less distance from the hot-house. An apartment heated with a flue of a large construction is less incident to sudden changes of temperature than where the flues are small. The heat in large flues can be regu-

* At Peterhead, in Aberdeenshire, there is a dwelling-house with hollow walls of brick-work, belonging to a Mr. Leslie, of that place, who, I believe, has thoughts of taking out a patent for his ingenious method of making bricks, and building houses with a double or hollow walls.

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lated with much precision, and they are attended with the advantage of seldom or never requiring to be cleaned. In all chimneys of this kind an aperture should be made in the wall with a close shutter, near the top of the chimney, where a lighted candle or lamp should be introduced, for an hour or two, immediately after the fire is put on, in order to create a current, and thereby bring the smoke to issue at the chimney top.

On preventing the Worms in Carrots, and on preserving Cauliflower through a great Part of the Winter.

By Mr. SMITH, *of Keith Hall.*

From the TRANSACTIONS of the CALEDONIAN HORTICULTURAL SOCIETY.

I. *On preventing the Worms in Carrots.*

ABOUT five years ago I had a heap of pigeon-dung, which lay through the winter months on a quarter of the garden. Having occasion to remove all this dung to other parts of the garden, I laid down the quarter with carrots, and was surprised to observe an extraordinary production of this vegetable on the spot where the dung had lain, both with respect to their size and cleanness. And although some worms might have been found in the other parts of the quarter, yet I could perceive none in the spot above alluded to.

From that time, this circumstance induced me to adopt the practice of sowing my carrots always in one particular spot of ground, which I have annually manured well with pigeon-dung, laying on almost as much of it, though of a hot nature, as if it had been rotten horse-dung. And I have the satisfaction to observe, that I have never failed to have an extraordinary crop, and, what is of more consequence,

sequence, can venture to affirm, that a worm could not be found in my carrots during the four years that I have continued this practice.

Last year, in thinning my carrots, I transplanted a few of them into a piece of ground that had been well dunged with rotten horse-dung; and though they grew very well, yet they were so much cankered that they were almost unfit for any use.

All this leads me to think, that pigeon-dung is a good preventive of the worm in carrots.

II. *On preserving Cauliflower through a great Part of the Winter.*

As cauliflower is a most desirable vegetable, so it deserves to be kept as long for use as possible.

In 1808 I had a large quantity of this vegetable in full head in the beginning of November. Being at a loss for a shed, or such place as is commonly used for hanging it up, in order to preserve it, I dug a pit along the bottom of a wall, about eighteen inches in depth, and much about the same breadth. On a dry day I pulled up the stocks of cauliflower, keeping the leaves as entire as possible, and rapping them round the flower. I began at one end of the above-mentioned pit, laying in my cauliflower with the roots uppermost, and the tops inclining downwards, the roots of the one layer covering the tops of the other, and so on with the whole of my stock. The pits were then covered closely up with earth, and beaten smooth with the back of the spade, in order that the rain might run off.

It is to be observed, that the covering had a considerable slope from the wall. The experiment succeeded to my wish; and I was able occasionally to give a dish of fine cauliflower till the middle of January 1809.

Receipts

Receipts for making Currant-Wine, during the Years 1810, 1811, *and* 1812.

From the Transactions of the Caledonian Horticultural Society.

AMONG other prizes announced by the Caledonian Horticultural Society, for the years 1810 and 1811, honorary premiums were proposed for the best currant-wines; and it was required, that each competitor should send an account of the method employed in preparing the wine. In consequence of this proposal, medals were awarded to several different ladies, as will be seen from the list of prizes, published in the first number of those Memoirs, p. 24; and the following are the receipts which were given in with the three wines wnich were adjudged to be the best in each of these two years.

September 1810.

No. 1. "To every English pint of the juice of fully ripe white currants, were added two English pints of cold water, and one pound of raw sugar.

"The fermentation was promoted by gentle agitation every day for eight or ten days. But no article was added to promote fermentation.

"When it appeared from the taste, that the liquor had obtained the pure vinous state, without either great sweetness on the one hand, or any obvious acidity on the other, which state was acquired in about the space of a month, the further progress of fermentation was checked by the addition of a small quantity of pure ardent spirit. One bottle of good whisky, free from any peculiar flavour, was added to twenty gallons of the wine.

"After this, the cask was bunged up, and allowed to remain at rest for six months. The pure wine was then racked

racked off from the sediment, into another cask, in which it was allowed to remain twelve months before it was bottled.

"The wine now sent to the Caledonian Horticultural Society, marked *Vino pellite curas*, was prepared in autumn 1805; so that it is at present five years old.

No. 2.—The wine to which the second prize was awarded was marked *On n'est jamais trop vieux pour apprendre.* The following was the receipt which accompanied it.

"One Scotch pint of currant juice;
One Scotch pint and a half of water;
Three pounds of sugar; half lump sugar, and half soft sugar.

"Mix them together in a tub, then fill your barrel. What is over, keep for filling up, as it works over; but it is better not to fill up more than twice. When done working, add one Scotch pint of aquavitæ or brandy, to twenty pints of the fermented liquor.

"The wine sent, is flavoured with a small quantity of clary wine, the growth and manufacture of Drumsheugh."

No. 3.—With the wine marked

Beatus ille qui procul negotiis,
....
—Horna dulci vino promens dolio,
Dapes inemptas apparet,

the following receipt was sent:

"Squeeze the currants, when fully ripe, through a hair-searce. To every Scotch pint of juice, add two of cold water; and to every Scotch pint of liquid so mixed, a pound and a half of raw sugar. Dissolve the sugar thoroughly in some of the water before it be put into the barrel. It will begin to work in twenty-four hours. Fill it up every second day with sugar and water made very sweet,

sweet, (about one pound of sugar to a Scotch chopin of water), first taking off all the scum with a spoon.

"If the weather happen to be very hot, and the fermentation go on very briskly, filling up every third day will do better than every second day. When the fermentation is over, bung it up close, and paste brown paper over the bung. Put leather between the bung and the barrel, to keep it very close. Bottle it nine months afterwards."

September 1811.

No. 1.—The first prize was adjudged to wine marked *The true Falernian*, with which the following receipt was transmitted.

"This currant-wine was made in the year 1805, in the proportion of one English pint of currant-juice, to two of water, with one pound of sugar; but with the Dutch red currant, which the makers of it consider as a great improvement, from the effect which that kind of currant has, both on the colour and taste of the wine; and on that account, it ought certainly to be more cultivated.

"Wine made of the Dutch red currant does not require any spirits; and will keep as well as any foreign wine."

No. 2.—Was marked *Veritas*, and according to the sealed letter which accompanied it, the fruit, sugar, and water, were as under:

"To every Scotch pint of juice, a pint and a half of water; and to every pint of the mixture, a pound and a half of sugar."

No. 3.—Was marked *Noble deeds are done by wine.* According to the receipt sent, it was prepared in the following proportions.

"One English pint white-currant juice;
One English pint water;
And one pound of raw sugar.

At the end of ten days, the fermentation was moderated by the addition of a little malt spirit."

September 1812.

For the year 1812, a prize-medal was offered for the best home-made wine without the use of any imported material excepting sugar.

Thirty-two different kinds were presented to the Society, many of which were excellent. But the judges gave the preference to a wine marked

Ce vin d'Ecosse
Merite quelque chose;

which was found to have been prepared according to the following receipt:

"For a twenty pint cask, five one-half pints of white-currant juice, eleven pints of water, and twenty-eight pounds of sugar are required. Mix all in a large tub; skim the liquor well; put it in a barrel, and fill up the barrel with water and sugar (one pound of sugar to a pint of water,) as long as the liquor ferments; afterwards add half a bottle of whisky; then bung up the barrel. The wine will be ready for bottling by April or May."

On the Employment of Sulphate of Soda (Glauber's Salt) in Glass-making.

By M. Marcel de Serres.

From the Annales des Arts et Manufactures.

M. MARCEL was induced, in consequence of the trials made by Messrs. Baaden and Gehlen, in Germany, on the employment of sulphate of soda in glass-houses, to make a course of experiments, in order to determine on the method that might be most advantageously followed in this process.

The results of these different experiments are:

1. That Glauber's salt may be employed in the place of potash and soda, for the vitrification of silex, and that the glass obtained by this process is as good and fine as what is obtained by the common processes.

2. The vitrification of Glauber's salt with quartz, is but imperfect, even in the hottest fire; it is more perfect if lime be added to it, but this process is longer and requires a still stronger fire. Indeed, a perfect vitrification is obtained, by adding to the mixture which takes the sulphuric acid from the Glauber's salt, an acid which neutralises the action of the carbonate of this salt upon the silex. The most simple method for this purpose is to employ charcoal, as oxyd of lead is used for flint-glass. This operation can be done as well before as during the vitrification; it depends upon circumstances, but in all cases, it must be observed:

1. That the property of colouring the glass, prevails stronger in charcoal, even when employed in a very small quantity, than in any of the metallic oxyds.

2. That lime quenched by water is preferable to that which is quenched by the air.

3. That as the substance which has Glauber's salt for a solvent forms an abundant skim, it should be thrown into the pots only a little at a time.

4. This process requires that the labour be judiciously distributed, so that the person who attends to the mixtures and the fusion may not be diverted from these objects.

5. Glauber's salt, calcined with charcoal, is worth more than in its crude state; indeed much care is requisite in the choice of the substances of which the pots are manufactured, in order that they may resist the action of the mass in fusion.

We find Glauber's salt in several salt-works; it can however be procured, by crystallising the product of the combustion of the muriate with the vitriol of iron.

Iron filings mixed with sea-salt may be calcined together. During the calcination, the sulphurous part is converted into sulphuric acid, which puts the sea-salt into a state of solution; on being afterwards exposed to the air, the vitriol which is disengaged, then produces its effect.

It is in this manner that the Glauber's salt is manufactured in the mines of Frieberg in Saxony, but as this process does not appear advantageous, the following experiments were made in order to find a less expensive method.

In the first trial twenty parts of iron filings and twenty parts of sea-salt were taken.

In the second, twenty parts of iron filings and ten parts of sea-salt.

In the third, half of the product of the first experiment was combined with ten parts of iron filings.

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In the first trial where two parts of iron were combined with one part of muriate, the mixture was calcined twice in succession. At the last calcination, the greatest part of the muriate was converted into sulphate of soda, or Glauber's salt; but this process is not sufficiently simple, it consumes too much time, fuel, and labour. It is more advantageous to use instead of vitriol, native sulphureous pyrites, according to the process of *Van der Ballen*; by this means the preparation of the vitriol is avoided: finally, it must be observed, that the dry way is always preferable to the humid.

The employment of Glauber's salt in glass-houses, as a solvent, affords many advantages, as by this means a substance of little value is made to supply the place of potash which is commonly used; less time and fuel are consumed, and the glass obtained is more solid than the common glass.

Account of a Stone-coloured Paint. By *M.* Carbonel.

From the Annales des Arts et Manufactures.

M. CARBONEL having announced that by employing the serum of beefs blood, a stone coloured paint could be obtained capable of resisting the vicissitudes of the weather, and that it had perfectly succeeded in Spain, M. Guyton Morveau examined this process, and the following are the results of his experiments.

The serum of the blood decanted three or four hours after it is collected, applied to soft stone, gives it a yellowish tinge. It resists water when it is very dry. It does not adhere to hard stone. The serum mixed with chalk stains the fingers, but is washed off by water.

If a coat of the serum be laid on a soft stone, and if before it be dry, some lime-water be added rather thick, a white colour remains which covers it thinly, but which resists water. The serum mixed with quick lime, and passed through a sieve, according to the author's process, forms a paste which, diluted with the same mordant and laid on directly, covers the stone with tolerable equality, and gives to it a colour more or less yellow according as the colouring parts remain more or less in the serum. It often requires two coats, and sometimes a third.

This paint is not injured either by friction, or by washing with water.

When applied upon pasteboard, it does not dissolve with water, but it does not adhere so well as the composition called *Bachelier*.

M. Carbonel anticipated, that this composition could not be coloured by the metallic oxyds, not even by those of

of lead and copper, which is obtained with the red, yellow, and green earths, &c. M. Guyton endeavoured to substitute the serum for the paste in the composition called *Bachelier*, and he discovered that its adherence was nearly as strong; but that on washing it with water, some yellowish traces were left, produced by a commencement of disoxydation of the lead.

The solidity of this colour depends upon the state in which the serum is taken. This substance corrupts with so much facility, that it must be used the same day, or at the latest, within twenty-four hours, and no more prepared than can be used directly. As soon as the putrid odour begins to manifest itself, the paint produced comes off in scales, or powder.

Thus we see that with proper care the serum, although it gives a mordant more difficult to use, and of less body than the old paints (which is no doubt owing to the quantity of gelatine it contains), may, by uniting it with quick lime, be made to form a paint that resists water.

This composition has been long used in China, where before they varnish wood they sometimes give a first coat of quick lime, which they polish with pumice-stone when it is dry.

There may be some circumstances in which this composition may be used, in the place of and with rather less expense than some others, such as for covering exterior plaster work, where there is less inconvenience in laying a thick coat to preserve soft brick from injury by rain, and to give it the appearance of stone.

It is with this view that we can recommend it for trial.

On Mills, put in Motion by the re-action of Water, erected by M. MANNOURY, Dectot.

Exracted from a Report made to the INSTITUTE at PARIS, by Messrs. PERIER, PRONY, and CARNOT.

THE mechanism of these mills is founded on the principle of the re-action of the water on the vessel or reservoir from which it escapes.

The inventor causes the water to enter the mill-wheel at the lower part, along the axle. The column which brings the water, encloses the pivot upon which it turns. This water is brought to the reservoir through a curved canal, by means of which, the mill-wheel and the mill which it puts in motion, are placed by the side of the reservoir, and neither above nor below it, which would much injure the working and the simplicity of the machine as we shall show below.

The idea of employing in mechanics the re-action of water as a moving power is not new; however, it does not appear that it has hitherto been practised with the advantage that can be derived from the assistance of a re-acting machine.

M. Mannoury, by bringing the water from below by means of a canal, as we have said, reduces his machine to a simple water-wheel, to the axis of which is immediately fixed the moving mill-stone. Whereas in most of our mills, the wheel that receives the action of the water, acts upon the stone by the intermedium of one or more cogged wheels.

Those of M. Mannoury therefore, which do not require a greater fall than our ordinary mills and even less, have a great advantage, in that the mill-wheel which receives

ceives the action of the water, bears the moving mill-stone immediately upon its axle, which greatly simplifies the machinery, and considerably diminishes the resistance.

Although the water enters with little velocity into the mill-wheel, it causes it to turn very fast, because the apertures for its egress being much smaller than those for its entrance, the velocity at the entrance is reciprocally much smaller than it is at the egress; but this velocity at the egress is not an absolute velocity, for otherwise there would result a spontaneous augmentation of power, which would not agree with the principles of mechanics.

It must be observed that this machine, when it has received its just proportions, acquires of itself, the motion which is necessary for its *maximum* of effect; for when once the moving force is properly applied to it, the amount of the actual power which it tends to display, can no more annihilate than multiply itself.

By making an analytical calculation of M. Mannoury's machine, we have obtained results remarkable for their simplicity, and the facility of their application; that is to say, the apertures for the entrance and the egress of the water, being proportioned as they ought to be in order to obtain the greatest effect; then,

1. The re-action, that is, the force of pressure which acts upon the mill-wheel, at each of the apertures of egress, is equal to the weight of a column of water, of the same base as the aperture, and of the heighth of the level of water in the reservoir.

2. The velocity of the rotation of the mill-wheel to the same point, is to the velocity due to the heighth of the level of the water in the reservoir, as the aperture for the en-

entrance of the water into the mill-wheel, is to the sum of the apertures of egress.

Whence it follows, by multiplying this force and this velocity, that the effect produced by the machine in a given time, is equal to the weight of all the water that the reservoir can furnish during this time, by the heighth of the level of the water in the reservoir; now this product, it is well known, is the utmost that can be obtained from the best hydraulic machines.

Finally, M. Mannoury modifies his constructions according to circumstances. He invented the substitution of a wheel with a vertical axle, instead of the one before described to be entirely immersed in the water. This wheel, which is of copper, is three feet in diameter; its circumference is furnished with forty paddles or float-boards, of nearly one foot by three inches, very thin, and apart from each other about half an inch. These paddles are all inclined in the same direction on the circumference, and form a sort of circular venetian blind, in the middle of which is a space where the water is introduced from underneath by a large tube or canal. This wheel, by turning in the water in which it is immersed, meets with no sensible resistance, and answers the purpose as well as the one before described. It is imagined that the water, after having struck upon, or rather pressed only the paddles placed obliquely on the circumference, flies through the small intervals that are left between them.

The advantages of the mills invented by M. Mannoury would furnish us with subject for much interesting detail, into which we cannot enter; we shall confine ourselves to what has appeared to us to be most worthy of remark.

We have said, that he introduces the water into his wheel from underneath, which gives him the facility of placing

placing his machinery at the side of the reservoir, and to avoid connection by toothed wheels; but this disposition has besides another considerable advantage, which is, that the column of water which enters thus into the wheel, by pressing from below on the part above, with all the weight of the reservoir, sustains a great part of the weight of the machine, and consequently greatly diminishes the friction of the pivot against the socket in which it turns; while on the contrary, when the water enters at the top, as in the old re-acting machines, which is already very heavy of itself, this flowing water considerably augments the weight, and consequently the resistance. We are nevertheless sensible that this disposition cannot take place, except where the bulk of water is not very considerable.

2. It may be asked how M. Mannoury can cause the water to enter the wheel which turns, while the conduit which brings the water is immoveable. We apprehend that he can accomplish this object, by causing the pipe that brings the water to enter the collar of the wheel, so as to leave very little play between them, and also by furnishing this small interval with a leather collar; but M. Mannoury has found a more ingenious method, by furnishing the tube at bottom which is fixed, and the moveable collar of the wheel, with several cylindrical and concentrical surfaces which fit one into the other without touching. The water fills the deep and close grooves formed by the cylindrical surfaces, and is sufficient to prevent that which is forced into the wheel from escaping by the sides.

3. One of the operations most difficult to the miller, is to place and maintain his running stone upon its axis, so that it shall turn perfectly horizontal. The least shock deranges it, and then it rubs against the other stone, or

it is too tight on one side, while the other is too loose, which makes one part of the grain too fine, and the other too coarse. M. Mannoury has found a simple and expeditious method of giving immediately to the stone its proper situation, by rendering the piece of iron which terminates the axis of this stone, a little convex at the upper part. Hence the equilibrium of the mill-stone on this axis becomes steady, so that it takes of itself the proper position, and if it happen to be a little deranged, it naturally regains its former situation.

4. The author has discovered by multiplied experiments, that the fixed stone should be perfectly flat, instead of being dressed somewhat conically as is customary.

We can suppose indeeed that when the fixed stone is dressed conically, if the running stone happens to be ever so little out of its level, the interval between the two stones becomes very irregular, and the grinding is ill performed: as for the running stone, experience proves that it must retain its common form, which is that of a hollow cone, but which is hardly perceptible.

5. The learned Belidor had affirmed in his hydraulic architecture, that to succeed best in the grinding, the furniture of the running stone should be very elastic, because he thought the trembling motion of this stone served to assist in crushing the grain; but it appears certain, from the experiments of M. Mannoury, that this motion is, on the contrary, very injurious; the firmer the pivot of the axis is fixed, the better is the grinding performed; in this case, the stone becomes in some degree sonorous, and the sort of humming noise that it makes, informs the miller that it is in the most favourable position.

6. Belidor

6. Belidor had also affirmed that the heavier the running stone is, the more considerable is its effect. M. Mannoury, on the contrary, has found that light stones produce the most effect, but only until they are heated; that then they produce less effect than the heaviest stones, because the latter heat more slowly; this is expressed by the millers when they say that the mill is tired and wants rest, that is, it must have time to cool.

7. M. Mannoury made in the presence of the commissioners, a course of experiments, to ascertain the effect of the re-acting machines that he employs in his mills. These experiments offer a series of facts, very useful to be known in practice. We have particularly remarked an ingenious expedient employed by the inventor, in order to render uniform the action of a variable power, such as the power of a man applied to a windlass, who is not always capable of employing the same degree of force and swiftness.

All these particulars are valuable, because they are the result of experiments made upon the principle of profiting by every little circumstance, without blindly following the common routine established by custom.

We think that the mills of M. Mannoury exhibit a happy application of the re-acting power of water, which for their simplicity and useful effects, merit to be often employed instead of the common mills, and that his researches are worthy of the approbation of the class.

List of Patents for Inventions, &c.

(Continued from Page 320.)

James Penny, of Low Nibthwaite, in the parish of Colton, in the county of Lancaster, Mechanic; and Joseph Kendall, of Cockenstall, in the parish of Ulveston, in the said county, Turner; for an entirely new and improved principle or plan for the making of pill and other small boxes. Dated September 8, 1814.

William Lister, of Paddington, in the county of Middlesex, Esquire; for certain further improvements on an engine or machine for separating corn or seeds from the straw and chaff. Dated Sept. 27, 1814.

Joseph Taylor and Peter Taylor, of Manchester, in the county of Lancaster, Machine Makers; for having invented and brought to perfection certain improvements in a loom to be used in weaving cotton, linen, worsted, silk, or other cloth or cloths, made of any two or more of the said materials. Dated Sept. 21, 1814.

W. E. Sheffield, of the Polygon, Somers'-town, in the county of Middlesex, Gentleman; for divers improvements in the working or manufacturing copper, and its compounds and other metallic substances, or any or either of the same. Dated Sept. 21, 1814.

James Dobbs, of Birmingham, in the county of Warwick, Gentleman; for his improvements in the manufacturing of machines used for cutting and gathering in grain and produce arising from the earth, whereby much labour and expense are saved. Dated Sept. 21, 1814.

Ambroise Firmin Didot, of Holborn, London, Gentleman; for an improvement in the method of making

ing types or characters to be used in the art of printing. Dated October 3, 1814.

Abraham Shaw, of Leicester, in the county of Leicester, Glazier vice and Diamond manufacturer; for his apparatus for the better cutting of window, plate, and sheet glass. Dated October 3, 1814.

W. Sampson, of Acorn-street, London, Millwright; for certain improvements for raising water. Dated Oct. 3, 1814.

R. Phillips, of Newbury, in the county of Bucks, Engineer; for certain improvements in a plough. Dated October 5, 1814.

List of Patents for Inventions, granted in Ireland, since the 1*st of Janury* 1814, *to* 15*th September* 1814.

Edward Charles Howard, of Westbourne Green, in the county of Middlesex; for certain improvements in his process for preparing and refining sugars, for which his Majesty's Letters Patent bearing date at Dublin the 5th day of April, 1813, were granted to him; and certain apparatus to be used in carrying his said improvements or some of them into effect. Dated March 12, 1813.

Charles Grill, of Leicester-place, in the parish of St. Martin's in the Fields, in the county of Middlesex, and Frederick Dizi, of Park-place; for certain improvements on harps. Dated April 19, 1814.

John Sparks Moline, of Leadenhall-street, London, Leather-merchant; for an improved method of tanning leather. Dated April 23, 1814.

John Slater, of Birmingham, in the county of Warwick, Manufacturer of Coach Springs and Patent Steam Kitchens;

Kitchens; for an improvement in a steam boiler and apparatus for the purpose of washing, steaming, cleaning, and whitening cloaths, cloathing, and cloths; and for warming and heating closets, laundries, and other rooms by the same. Dated May 14, 1814.

John Vallance, junior, of Brighthelmstone, in the county of Sussex, Brewer; for apparatus for the certainly cooling brewers, vinegar-makers, and distillers worts, wash, &c. Dated August 13, 1814.

Edward Charles Howard, of Nottingham-place, in the parish of St. Mary-le-bonne, in the county of Middlesex, Esquire; for certain means of separating insoluble substances from fluids in which the same are suspended. Dated August 13, 1814.

PATENTS.

Persons desirous of obtaining Patents for Inventions may have them procured with very little Trouble to themselves, by Application to the Proprietors of this Work, and receive Assistance from them in drawing up and adjusting their Specifications, on the Perspicuity and Accuracy of which the Security of the Patent chiefly depends.

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